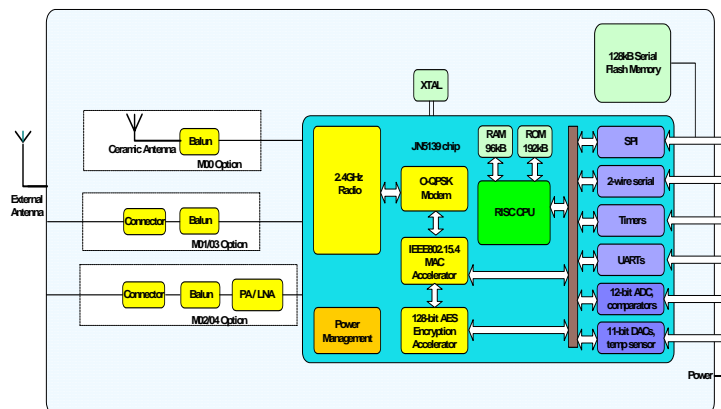


IEEE802.15.4 / ZigBee PIFA Module Family

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**

- Microminiature 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

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1. Introduction

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1.1 Key Features

1.1.1 Module

- 2.4GHz IEEE802.15.4 & ZigBee Compatible
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- 96KB RAM, 192KB ROM
- 4-input 12-bit ADC, 2 11-Bit DACs, 2 Comparators, Temperature Sensor
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- 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 |
| TwoWire Serial I/F (Compatible with SMBus & I ² C) | ✓ | 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 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

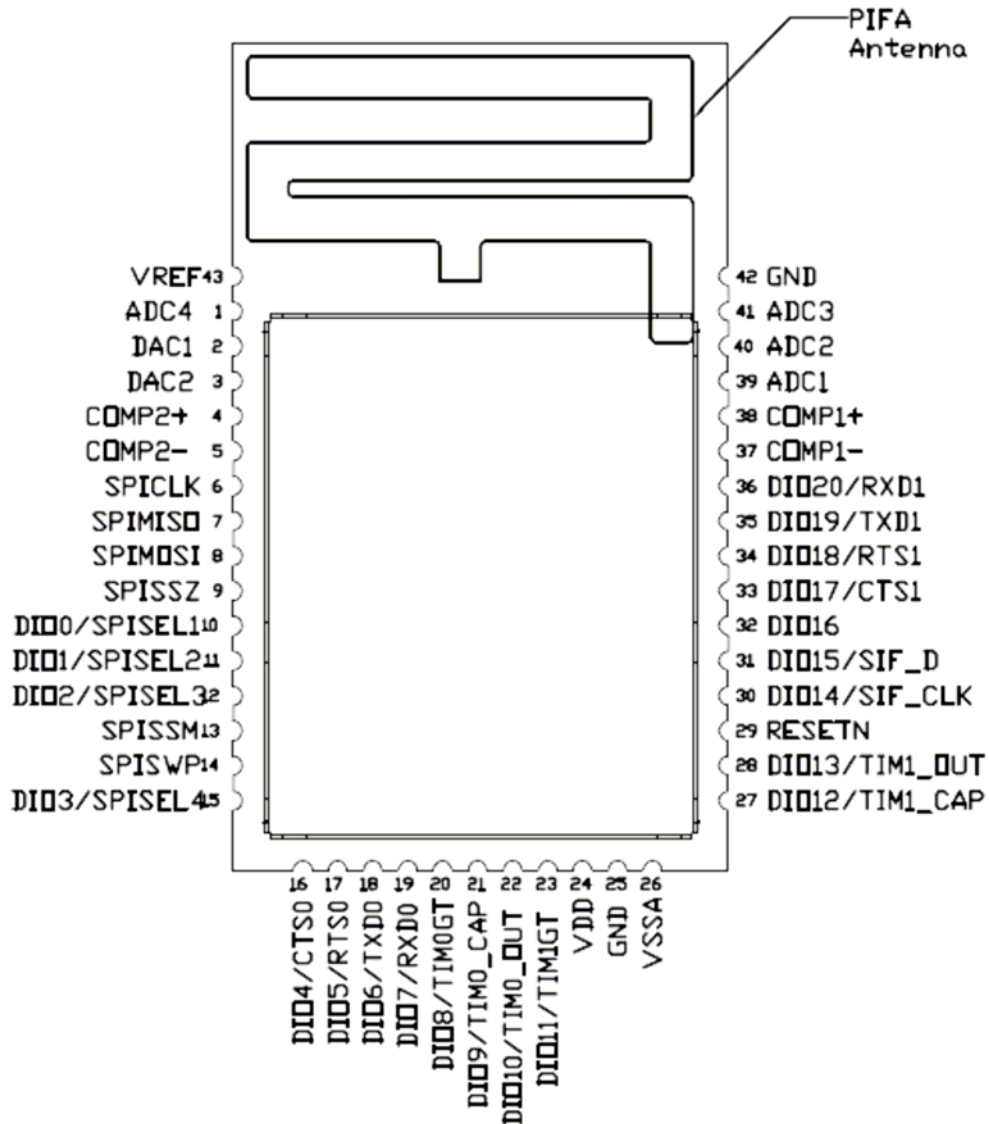


Figure : MD100A Pin Configuration(Top View)

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.

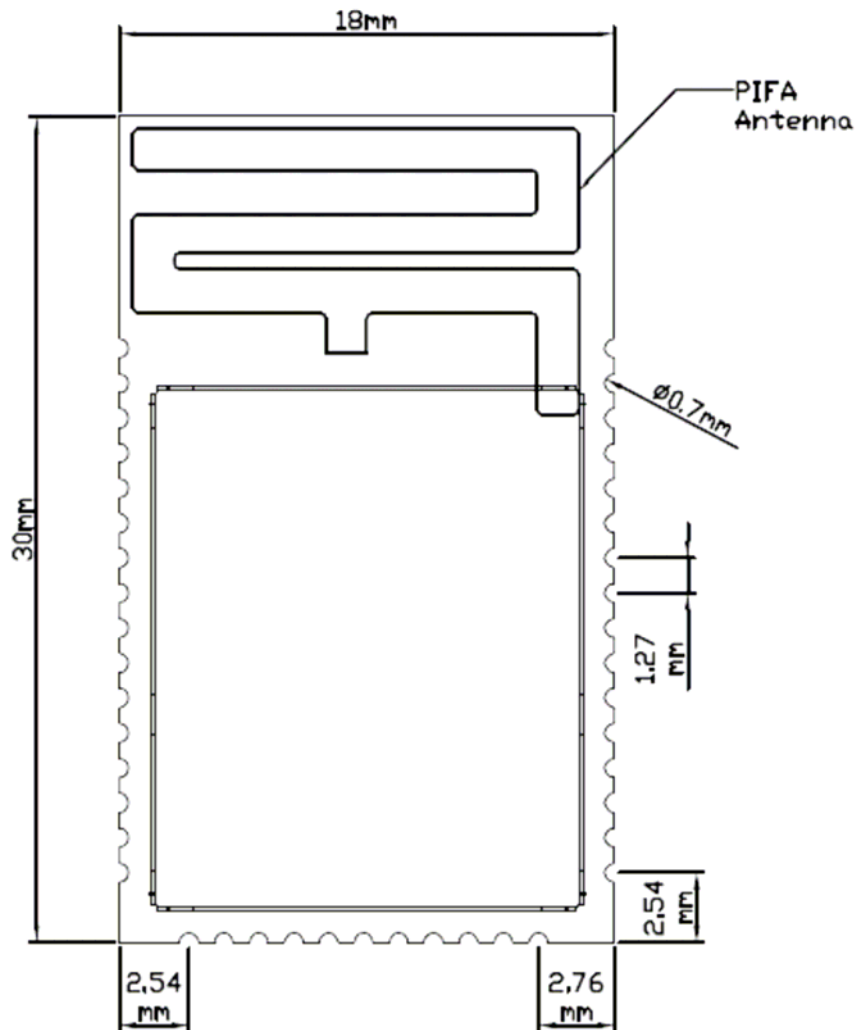
3.1 Pin Assignment

| 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 | 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 |
| 31 | SIF_D | Serial Interface data / Intelligent peripheral data out | General Purpose Digital I/O DIO15 |
| | | Intelligent peripheral device select | General Purpose Digital I/O |

| Pin | Signal | Function | Alternative Function |
|-----|--------|---------------------------------------|-----------------------------------|
| 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. Additional Information

4.1 Outline Drawing



Thickness: 3.5mm

Figure : MD100AB Outline Drawing

4.2 Module PCB Footprint

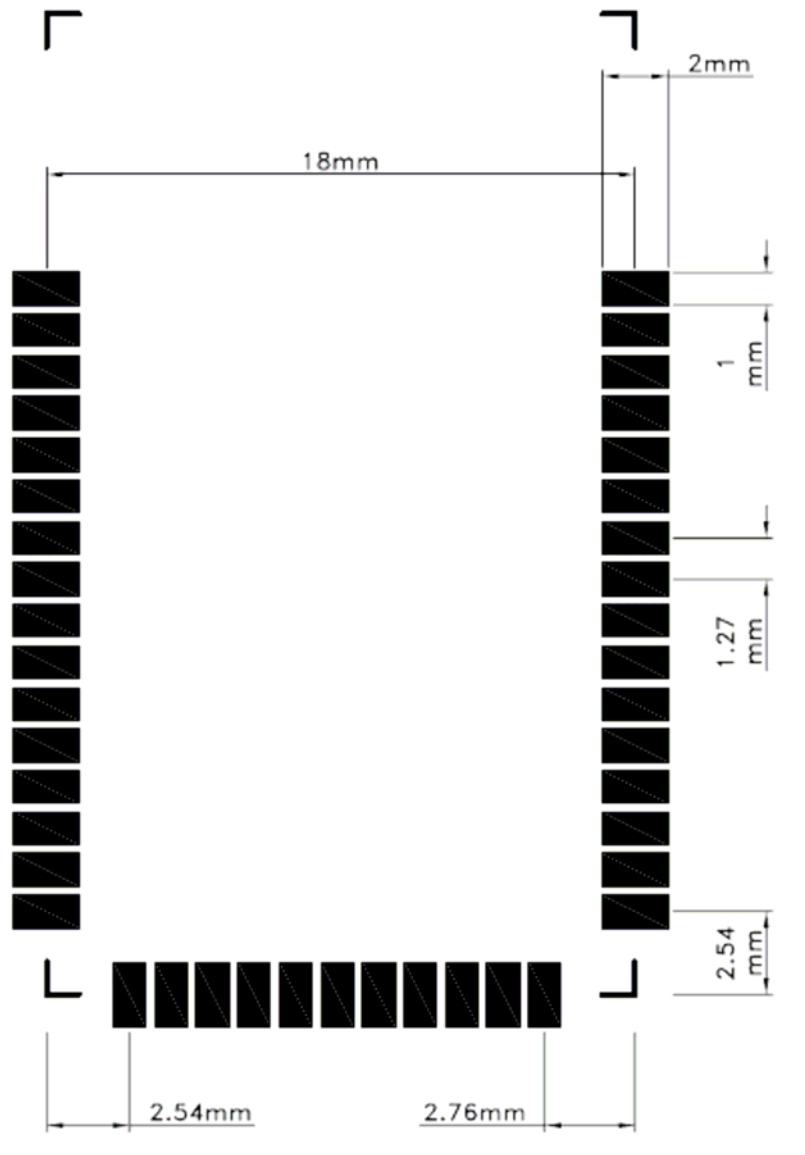
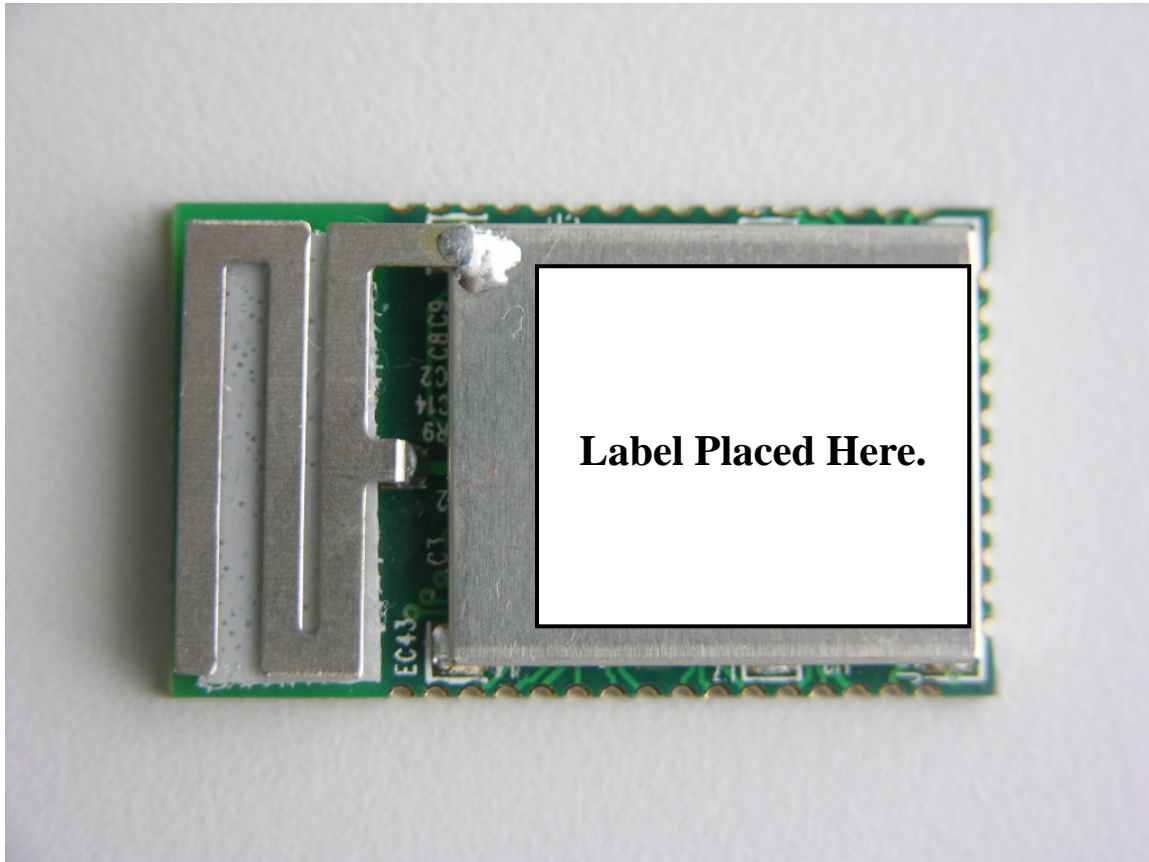


Figure : Module PCB footprint

RF note for MD100AB 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 : Lot Code
YYWWNNNNNN (See Below)

| Identifier | Description | Format |
|------------|---------------|------------------|
| YY | Year | 09 (Example) |
| WW | Week | 45 (Example) |
| NNNNNN | Serial Number | 000001 (Example) |

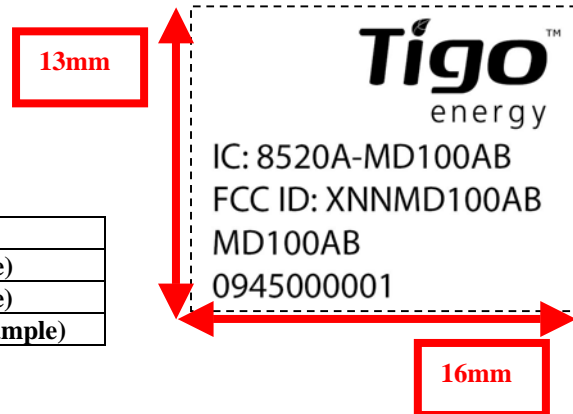
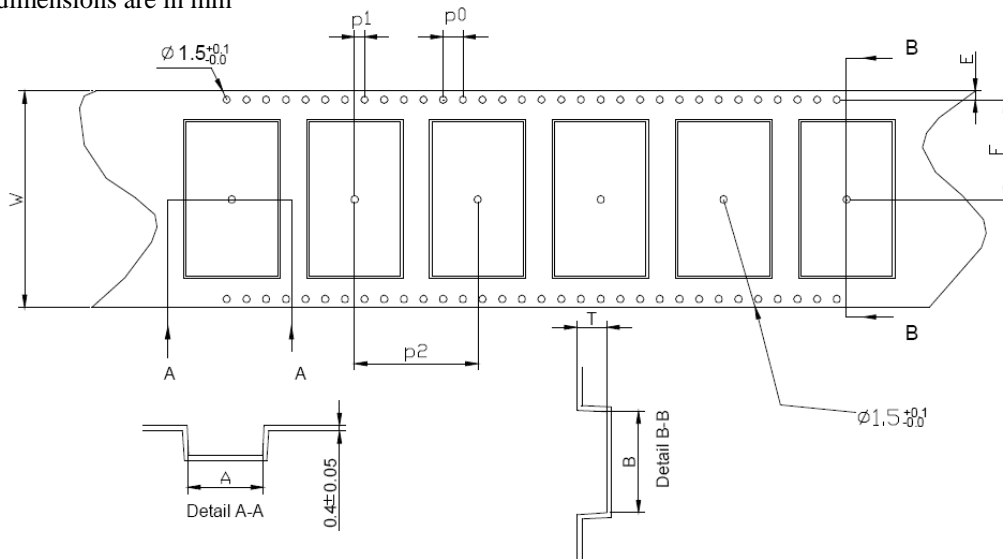


Figure : Example MD100AB Labelling for FCC Approved Modules

4.4 Tape and Reel Information

4.4.1 Tape Orientation and dimensions

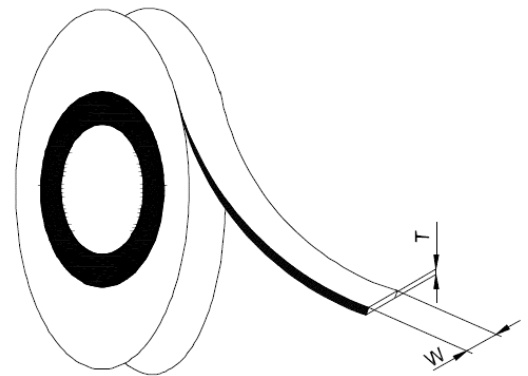
All dimensions are in mm



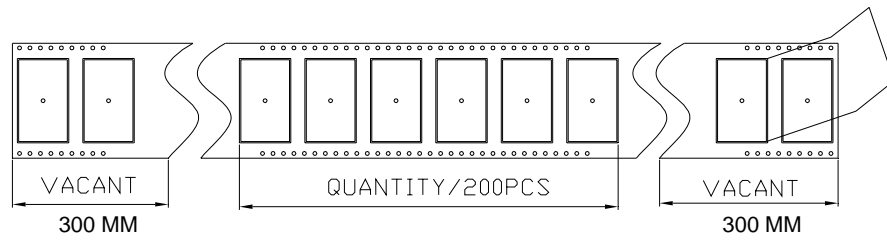
| Module type | A | B | W | F | E | P0 | P1 | P2 | T | Cover Tape width (W) |
|-------------|------|------|------|------|------|------|------|------|------|----------------------|
| MD100A | 18.4 | 30.4 | 44 | 20.2 | 1.75 | 4.0 | 2.0 | 24.0 | 4.0 | 37.5 |
| Tolerance | ±0.1 | ±0.1 | ±0.3 | ±0.1 | +0.1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

4.4.2 Cover tape details

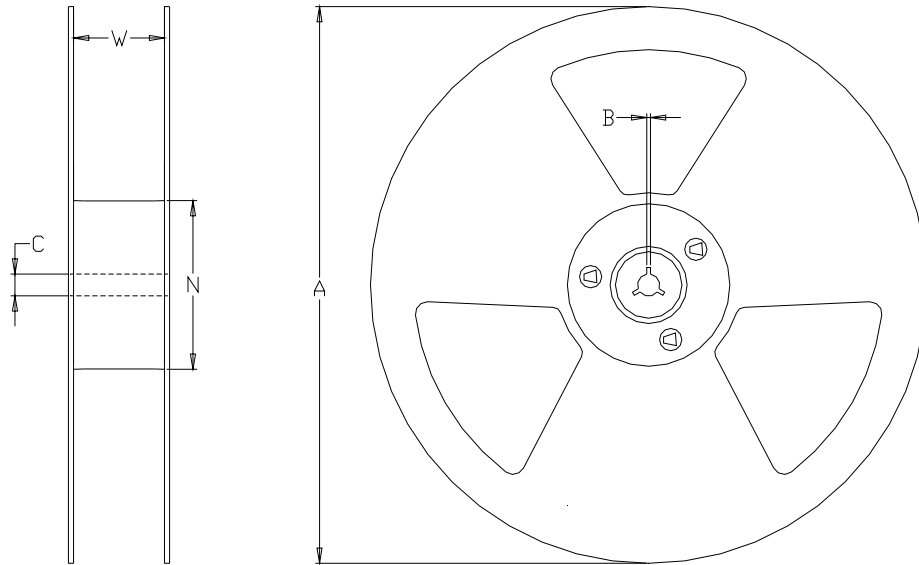
| | |
|--------------------------------------|--------------------------|
| Thickness (T) | 0.061mm |
| Surface resistivity (component side) | 10^4 to 10^7 Ohms/sq |
| Surface resistivity (component side) | Non-conductive |
| Backing type | Polyester |
| Adhesive type | PSA |
| Sealing | Room ambient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



4.4.3 Leader and Trailer



4.4.4 Reel Dimensions



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

4.5 SMT IR Profile

Average ramp-up rate (217°C to peak): 3 °C /sec. max.

Preheat : 150~200 °C 、 60~180 seconds

Temperature maintained above 217 °C : 60~150 seconds

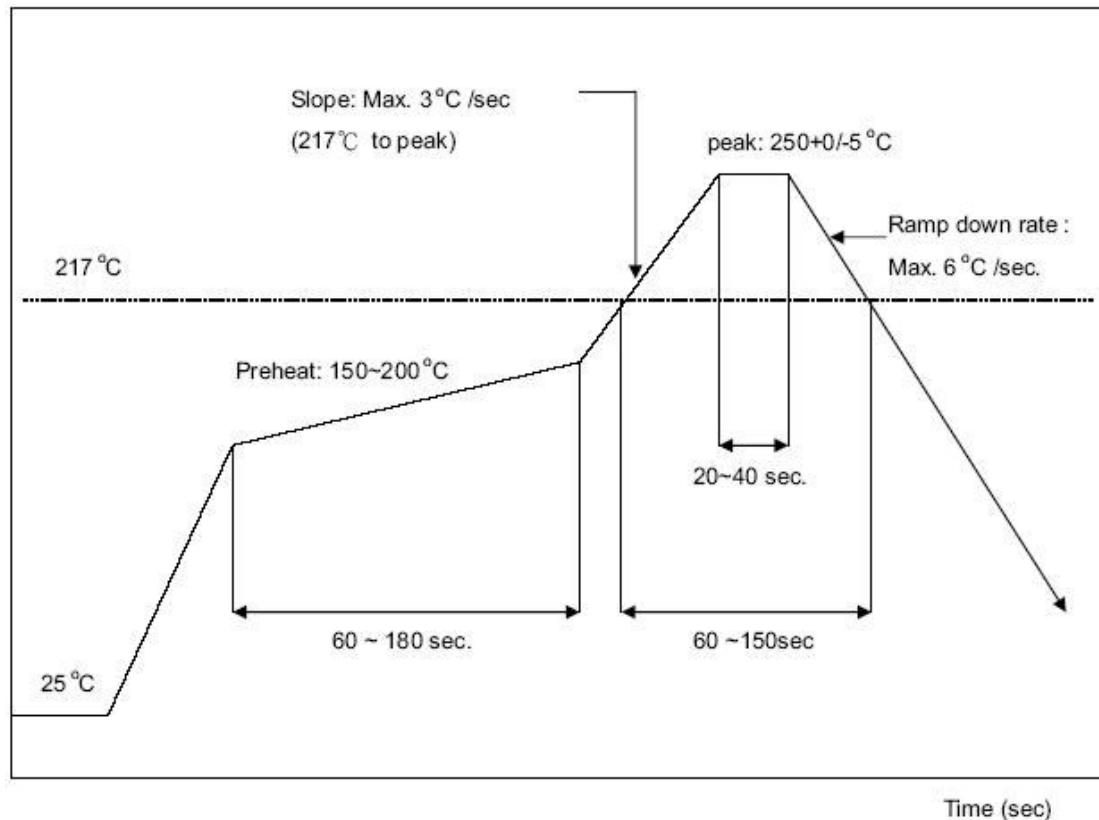
Time within 5 °C of actual peak temperature: 20 ~ 40 sec.

Peak temperature : 250+0/-5 °C

Ramp-down rate : 6 °C/sec. max.

Time 25 °C 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.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the 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

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

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 which is provided by OEM integrators for end users must include the following information in a prominent location. "To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. Label for end product must include " Contains FCC ID: XNNMD100AB" or " A RF transmitter inside, FCC ID: XNNMD100AB".