

MN5010HS GPS Receiver Module



1 Description

The Micro Modular Technologies MN5010HS Global Positioning System (GPS) Receiver is a complete, 20-channel receiver with high sensitivity that measures only 10mm by 10mm by 1.9mm. It features fast-acquisition hardware, integrated RF filtering, TCXO, reset circuits, real-time clock with on-board crystal, and an integrated LNA that allows operation with either active or passive antennas. The user needs only provide DC power and a GPS signal; the MN5010HS will output the navigation solution in the widely-used NMEA-0183 protocol or in SiRF binary protocol.

The 20-channel receiver allows all satellites in view to be tracked, providing an over-determined solution to minimize position jumps caused by individual satellite blockage. The fast-acquisition hardware design greatly reduces the time for signal acquisition when the receiver is initially powered up. The MN5010HS operates from a single battery supply between 3.25 and 5.5 VDC. For even further power reductions, the OEM design may use a commanded power-saving mode.

The MN5010HS is supported by an evaluation kit, including software, along with reference designs to speed OEM development. The MN5010HS is machine placeable by standard surface mount equipment and is available in tube or tape and reel. A metal shield is provided for RF protection and for automated nozzle pickup.

1.1 Features

- Complete, 20-channel GPS receiver based on SiRFstarIII GPS technology
- Highly integrated design includes on-board LNA, TCXO, RF filtering, Reset circuit, Real Time Clock circuit and crystal
- Ultra-small 10 x 10 x 1.9 mm 36-pin LGA package
- Less than 100 mW total power consumption
- Fast-acquisition design for rapid position determination under all startup and operating conditions.
- Extended commercial temperature operation (-20°C to +85°C)
- Supports active or passive antennas
- Standard serial protocols - NMEA-0183 or SiRF binary
- Pb free RoHS compliant
- Supports SBAS (WAAS, EGNOS, MSAS)
- Hardware development kit available



MN5010HS

1.2 Block Diagram

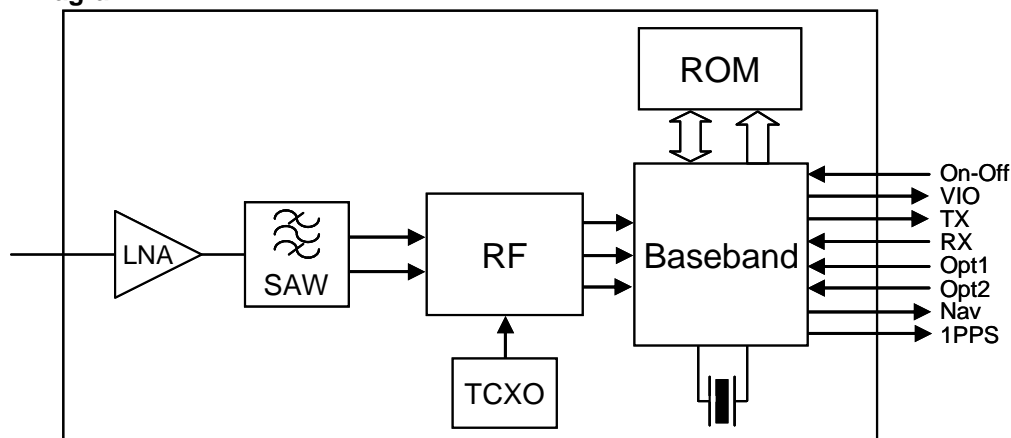


Figure 1 - MN5010HS Block Diagram

MN5010HS

GPS Receiver Module



1.3 GPS Performance

| Acquisition Time | Specification |
|--|---------------|
| Cold start TTFF (no time, no position, no ephemeris) | <35 seconds |
| Warm start TTFF | <35 seconds |
| Hot Start TTFF (time, position and ephemeris) | <1 second |

Table 1 – Acquisition Performance

| Positional Error | Accuracy |
|------------------|-------------|
| CEP | <2.5 meters |

Table 2 – Positional Accuracy

| Sensitivity | Typical |
|--------------------------|----------|
| Tracking | -159 dBm |
| Acquisition (Cold Start) | -142 dBm |

Table 3 – Sensitivity

2 Environmental

2.1 Operating

| | |
|-------------|--|
| Temperature | -20°C to +85°C |
| Humidity | Up to 95% non-condensing or a wet bulb temperature of +35°C, whichever is less |
| Altitude | -1000 feet to 60,000 feet |

Table 4 – Operating Requirements

2.2 Storage

| | |
|-------------------------------|--|
| Temperature | -40°C to +85°C |
| Humidity | Up to 95% non-condensing or a wet bulb temperature of +35°C, whichever is less |
| Altitude | -1000 feet to 60,000 feet |
| Shock | 18G peak, 5 millisecond duration |
| Shock (in shipping container) | 10 drops from 75 cm onto concrete floor |

Table 5 – Storage Requirements

MN5010HS

GPS Receiver Module



3 Electrical

3.1 Module Pin Descriptions

| Pin | Name | Pin Definition |
|-----|----------|--|
| 2 | GND | GND |
| 4 | RESERVED | This pin should be connected to ground through a zero Ω resistor. |
| 7 | RX0 | The MN5010HS GPS Receiver Module implements a single, full-duplex asynchronous serial UART port. This signal is used to input commands to the receiver in either NMEA or SiRF binary protocol depending upon the configuration of the receiver. In the idle condition, this pin is at logic 1. |
| 8 | TX0 | The MN5010HS GPS Receiver Module implements a single, full-duplex asynchronous serial UART port. This signal is used to output position, time and velocity information from the receiver in either NMEA or SiRF binary protocol depending upon the configuration of the receiver. In the idle condition, this pin is at logic 1. |
| 9 | 1PPS | This pin outputs a one-pulse-per-second (1PPS) signal, and is synchronized after the fix is valid. See section 3.4.3, 1PPS Signal. |
| 11 | GND | GND |
| 12 | VIO | This output comes from the internal 1.8V circuit, and can be used to determine the power state of the MN5010HS. Maximum supply is 5mA. |
| 13 | OPT1 | This input signal is used (with OPT2) to configure the operation of the MN5010HS. Please refer to the MN5010HS Design Guidelines document for more information regarding use of this pin. |
| 14 | OPT2 | This input signal is used (with OPT1) to configure the operation of the MN5010HS. Please refer to the MN5010HS Design Guidelines document for more information regarding use of this pin. |
| 20 | NAV | This output signal indicates navigation status. It pulses high when the receiver is in navigation (i.e., the fix is valid), and steady low when the receiver is not in navigation. |
| 22 | ON-OFF | This input signal is used to toggle the MN5010HS between the ON and HIBERNATE states. Please refer to the MN5010HS Design Guidelines document for more information regarding the use of this pin. |
| 23 | nMR | This input signal is used to reset the MN5010HS. If the user does not need this signal, it may be left unconnected. This signal will also wake up an MN5010HS receiver that is in the HIBERNATE state. Please refer to the MN5010HS Design Guidelines document for more information regarding use of this pin. |
| 24 | GND | GND |
| 27 | GND | GND |
| 29 | GND | GND |
| 30 | ANT | RF input: Connect to external antenna. See Section 3.3, RF Interface. |
| 31 | GND | GND |
| 33 | BATTERY | Power supply to module +3.25 to +5.5 volts DC |

Table 6 – MN5010HS Pin-out

MN5010HS

GPS Receiver Module



Note: The following pins have no internal connection: 1, 3, 5, 6, 10, 15-19, 21, 25, 26, 28, 32, 34-36.

3.2 Power Supply

The MN5010HS GPS Receiver Module is designed to operate from a single supply voltage ranging from 3.25 volts DC to 5.5 volts DC. Typically, the power is supplied from a Lithium Ion battery to Pin 33, the BATTERY pin.

| | |
|------------------------------|---------------------|
| Voltage | 3.25 VDC to 5.5 VDC |
| Current (typical) | 26.5 mA |
| Current (maximum) | 46 mA |
| Current (sleep mode) maximum | 25 μ A |

Table 7 – Main Power Supply

3.3 RF Interface

3.3.1 RF Input

The MN5010HS GPS Receiver Module accepts a standard GPS L1 signal (from a passive or active antenna) on the RF input pad of the module, which is pin 30, the ANT pin. If a passive antenna is used, no other circuitry is required. However, if an active antenna is required, then suitable means for powering the active antenna must be provided external to the MN5010HS GPS Receiver Module. The RF input is isolated from DC levels to a maximum of ± 15 VDC.

If power is required for an active antenna, MMT recommends that a quarter wave stub be used to prevent disturbing the matching of the antenna and MN5010HS module. The other end of the quarter wave stub should be AC grounded with a suitable microwave quality capacitor. Please refer to the MN5010HS Design Guidelines for more information.

| | |
|--------------|------------------------------|
| Signal Level | -160 dBm to -125 dBm typical |
| Frequency | L1 (1575.42 MHz) |
| Return Loss | Better than -10 dB |
| Noise Figure | 1.5 dB typical |
| Impedance | 50 ohms nominal |

Table 8 – RF Signal Characteristics

3.3.2 Burnout Protection

The MN5010HS GPS Receiver Module can accept signal levels up to -20dBm with a DC voltage of ± 15 VDC on the RF input pin without permanent damage to the module.

MN5010HS GPS Receiver Module



3.3.3 Jamming Performance

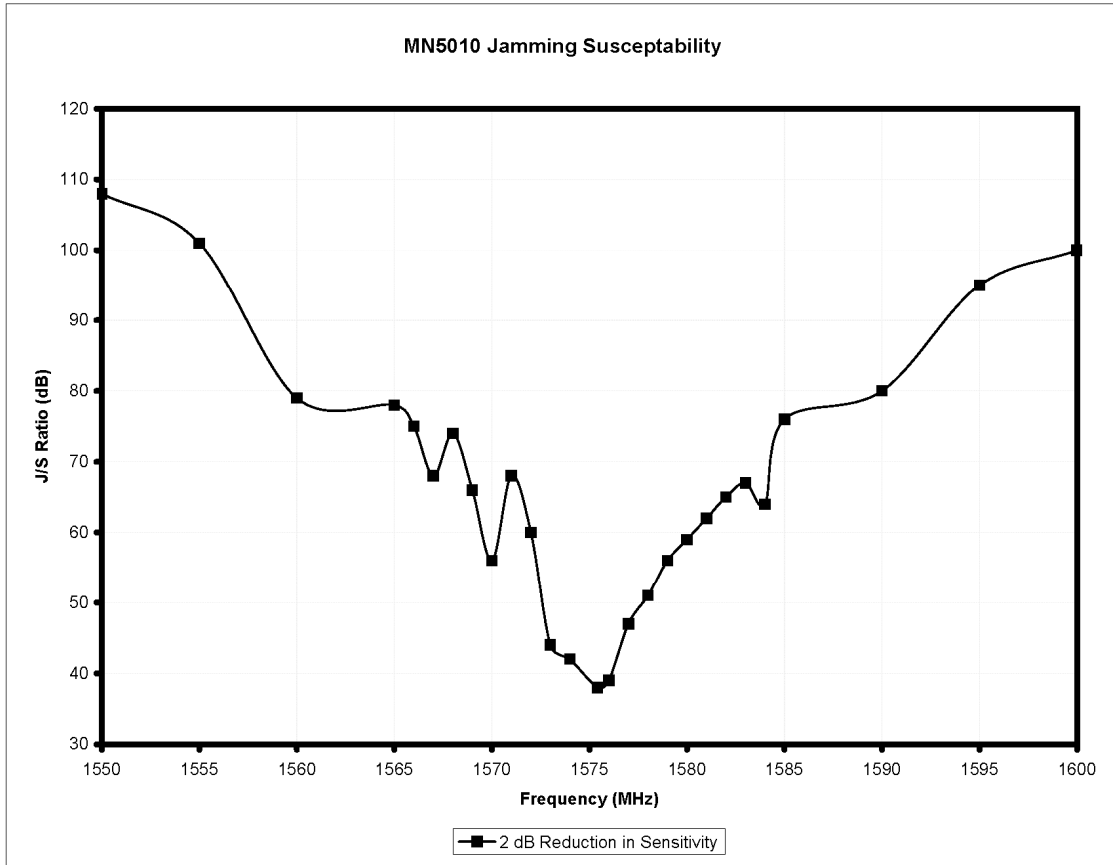


Figure 2 – Jamming Performance

3.4 Signal Interface

3.4.1 Digital Interface Levels

VCC is nominally 1.8 VDC.

| | |
|----------|----------|
| VIH(min) | 1.35 VDC |
| VIH(max) | 1.8 VDC |
| VIL(min) | 0.0 |
| VIL(max) | 0.45 VDC |
| VOH(min) | 1.6 VDC |
| VOL(max) | 0.20 VDC |

Table 9 – Digital I/O Interface Levels

3.4.2 Serial Interface

A serial data port provides data communications to and from the MN5010HS GPS Receiver Module. Please refer to the MN5010HS Design Guidelines for more information.

MN5010HS

GPS Receiver Module



3.4.3 1PPS Signal

The 1PPS signal (pin 9) is only valid when the receiver is in 3D navigation mode.

| | |
|--|---------------------------|
| 1PPS Signal Accuracy | 200 nanoseconds |
| 1PPS Signal Offset from UTC 1 Second Epoch | 450 nanoseconds, trailing |

Table 10 – 1PPS Signal Characteristics

3.4.4 RESERVED Signal

Pin 4 should be tied to ground through a zero Ω resistor.

4 Software Interface

4.1 NMEA Data Messages

The MN5010HS supports the NMEA-018 v3.0 messages:

| ID | Description |
|-----|-------------------------------------|
| GGA | GPS fix data |
| GLL | Latitude and longitude |
| GSA | DOP and active satellites |
| GSV | Satellites in view |
| RMC | Recommended Minimum GNSS Data |
| VTG | Course over ground and ground speed |
| ZDA | Time and date |

Table 11 – NMEA Messages

For detailed information regarding these messages, please refer to the SiRF NMEA Reference Manual.

4.2 NMEA Proprietary Commands

The MN5010HS recognizes the following NMEA proprietary commands:

| ID | Description |
|-----------|-------------------------------|
| \$PSRF100 | Set Serial Port |
| \$PSRF101 | XYZ Navigation Initialization |
| \$PSRF103 | Query/Rate Control |
| \$PSRF104 | LLA Navigation Initialization |
| \$PSRF106 | Select Datum |

Table 12 – Proprietary NMEA Commands

For detailed information regarding these messages, please refer to the SiRF NMEA Reference Manual.

MN5010HS

GPS Receiver Module



4.3 SiRF Binary Messages and Commands

For detailed information regarding the SiRF Binary protocol, please refer to the SiRF Binary Protocol Reference Manual.

5 Referenced Documents

| | |
|---------------------------------------|--|
| SiRF NMEA Reference Manual | |
| SiRF Binary Protocol Reference Manual | |
| MN5010HS Design Guidelines | |

Table 13 – Referenced Documents

MN5010HS

GPS Receiver Module



6 Packaging and Marking Information

6.1 Package Dimensions and Component Marking

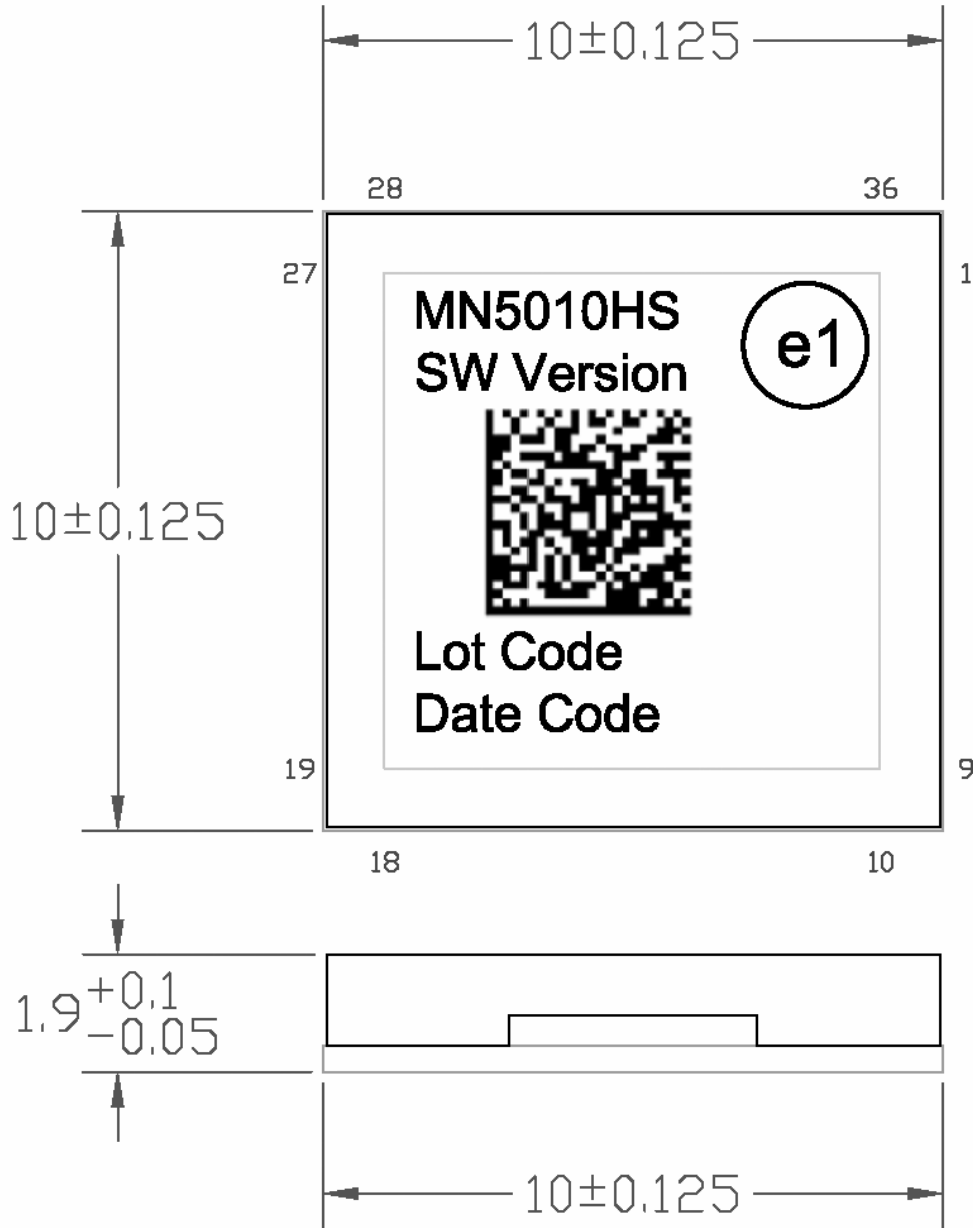


Figure 3 – Package Outline & Marking (in mm) : 36-pin LGA

Note the JEDEC Pb-free symbol is also used as the pin 1 identifier for the MN5010HS.

MN5010HS GPS Receiver Module



6.2 Recommended PCB Footprint

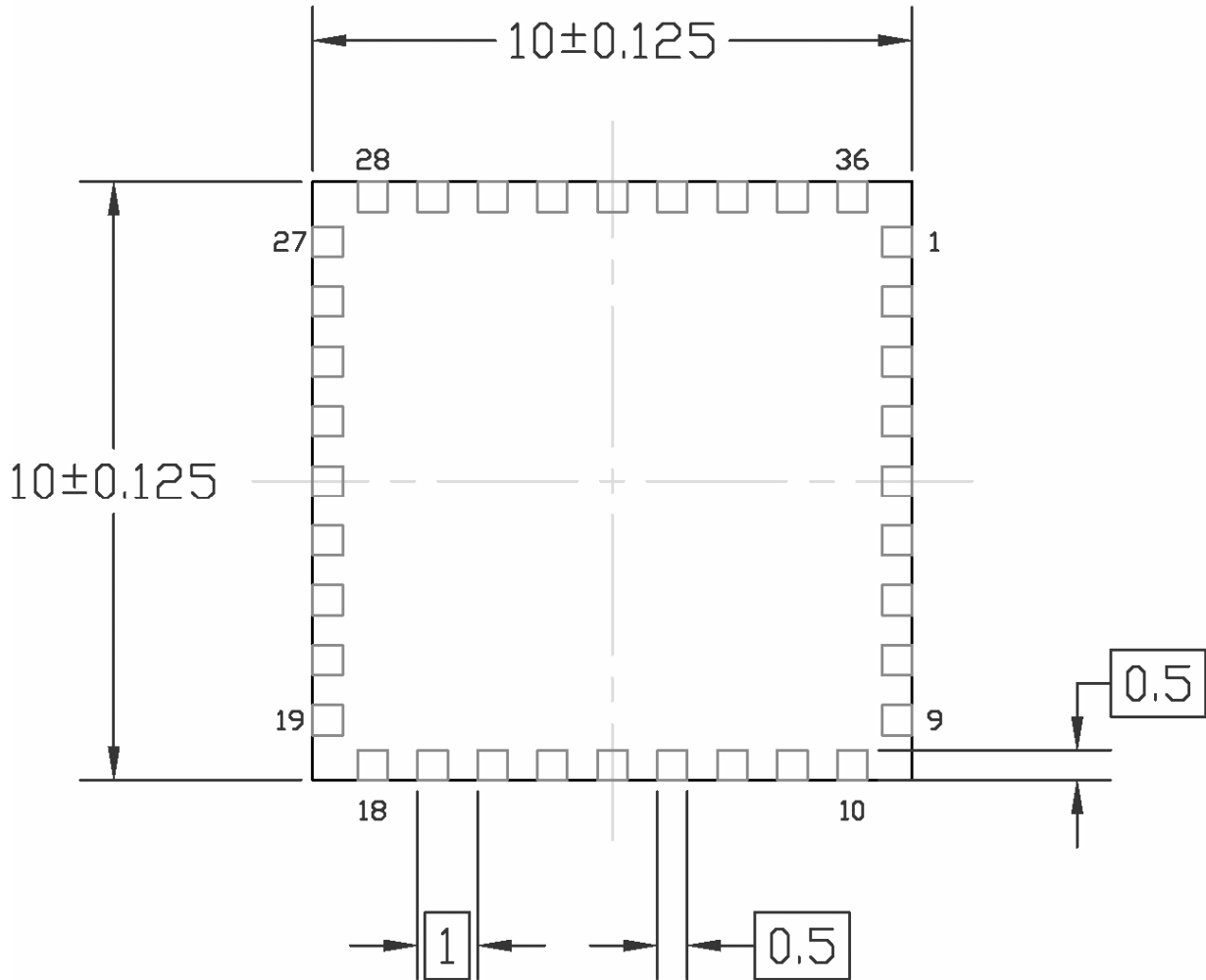


Figure 4 – Recommended PCB Footprint (in mm)

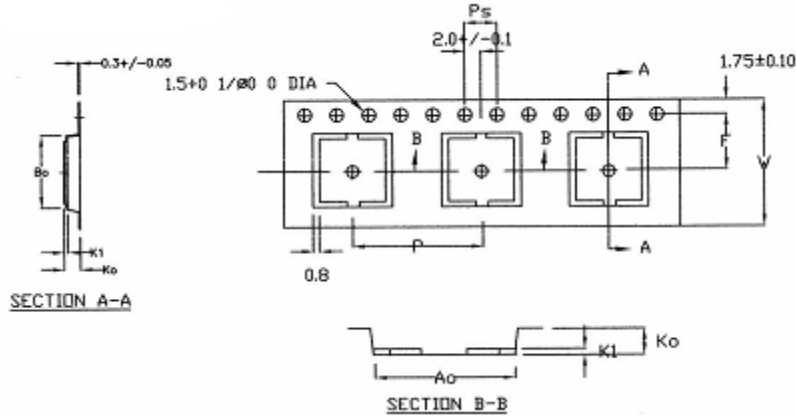
Figure 4 is a suggested PCB footprint for the MN5010HS. The user may need to adjust the pad dimensions based upon their manufacturing process. While solder mask covered traces are permissible underneath the MN5010HS, exposed vias or pads should be avoided.

MN5010HS GPS Receiver Module



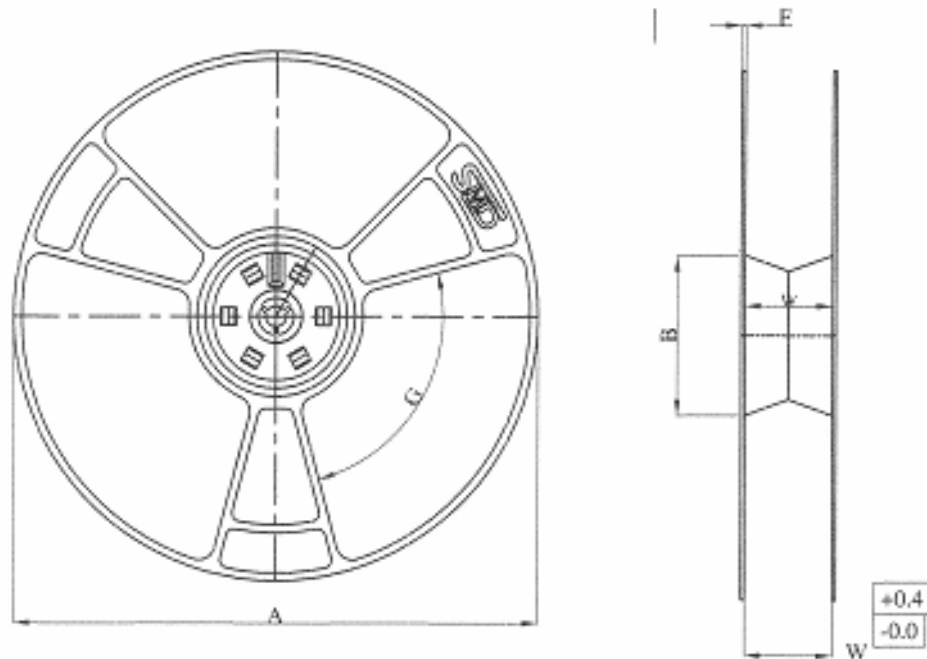
6.3 Tape and Reel Information

The MN5010HS is provided in standard tape and reel, with 2K devices per reel.



| Dimensions | W | P | Ao | Bo | Ko | K1 | Ps | F |
|------------|-------|-------|-------|-------|------|------|------|-------|
| Nominal | 24.00 | 16.00 | 10.40 | 10.40 | 1.50 | 0.40 | 4.00 | 11.50 |
| Tolerance | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |

Figure 5 – Carrier tape dimensions (in mm)



| Reel Part No. | A | W | B | F | G |
|---------------|-----|------|-----|-----|-----|
| SMD/H4/W24 | 330 | 24.4 | 100 | 2.2 | 90° |

Figure 6 – Reel Dimensions (in mm)

MN5010HS GPS Receiver Module

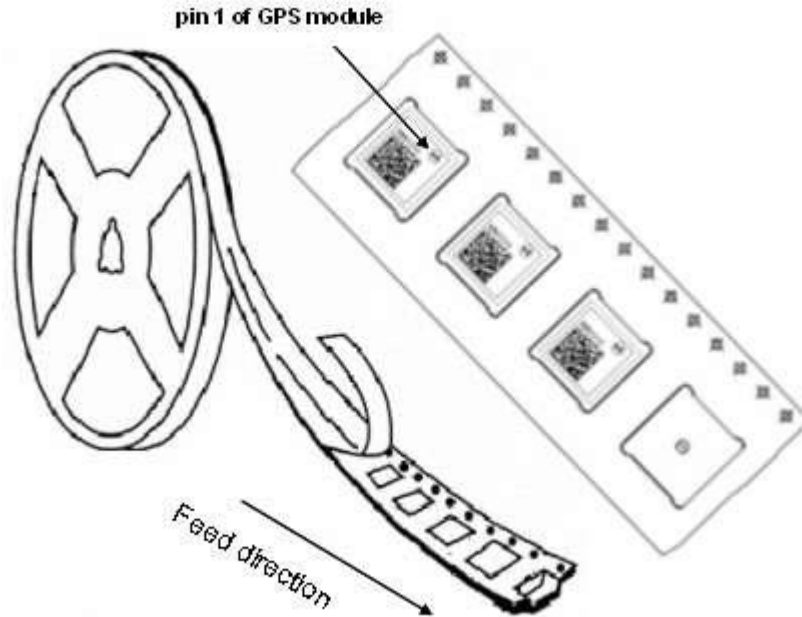


Figure 7 – Orientation in tape

6.4 Tube packaging

The MN5010HS is also available in tube form, with 48 devices per tube. The length of the tube is $501\text{mm} \pm 0.1\text{mm}$.

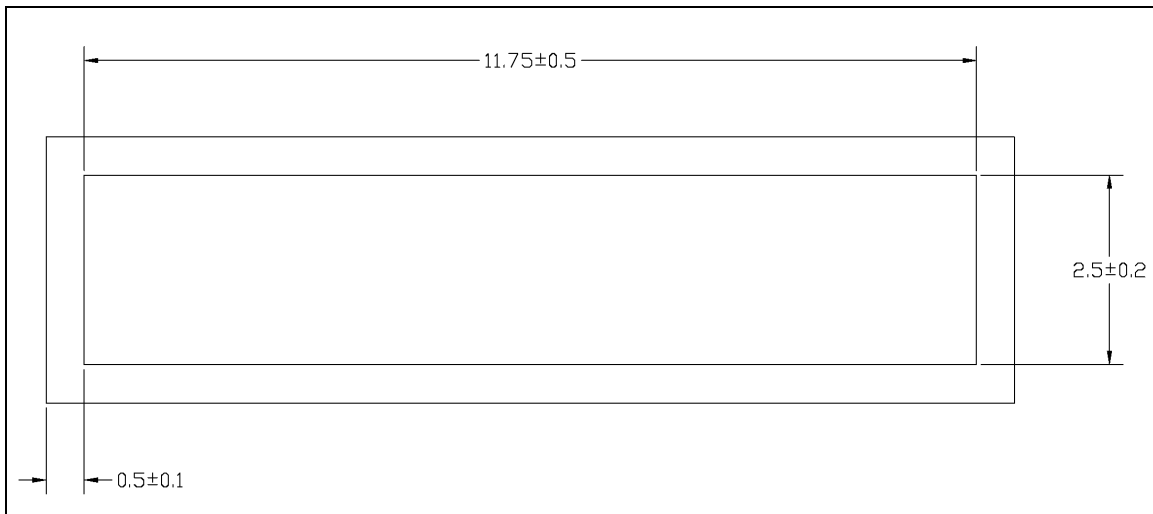


Figure 8 – Tube dimensions (in mm)

MN5010HS GPS Receiver Module



6.5 Recommended Reflow Profile

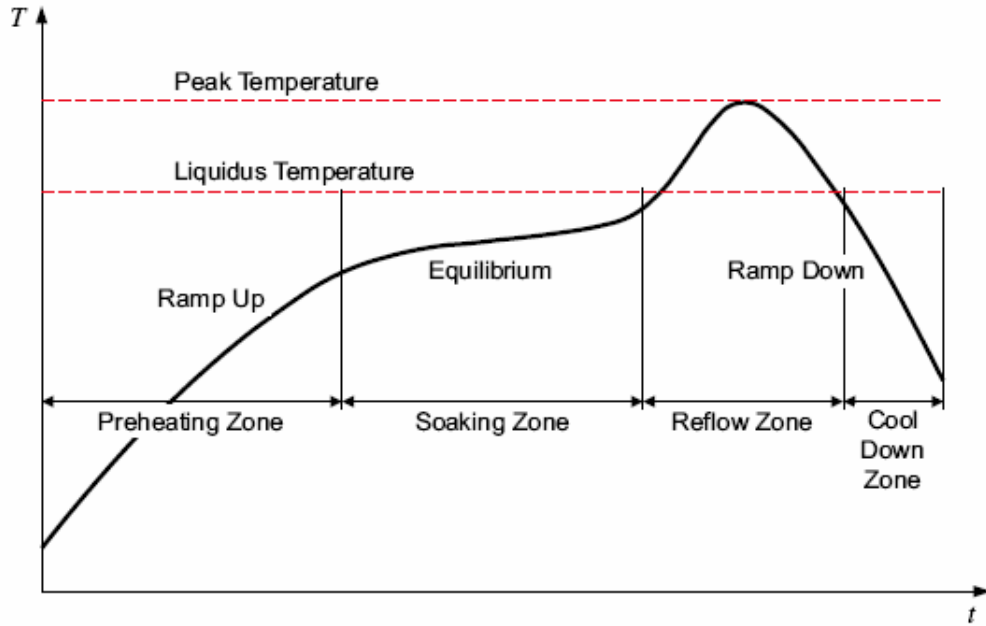


Figure 9 – Reflow Profile

| Reflow Parameter | Specification |
|---------------------------|----------------|
| Preheating Rate | 2.5°C/second |
| Soaking Temperature | 140°C to 170°C |
| Soaking Time | 80 seconds |
| Peak Temperature | 260°C |
| Reflow Time over Liquidus | 60 seconds |
| Cool down Rate | 2.5°C/second |

Table 14 – Reflow Parameters

7 Ordering Information

The ordering part numbers are contained in the table below:

| Ordering Part Number | Description |
|----------------------|-------------------------|
| MN5010HS-RS | MN5010HS in tape & reel |
| MN5010HS-TS | MN5010HS in tube |

Table 15 – Ordering Information

MN5010HS

GPS Receiver Module



8 Notices

All reference and informational documents (including marketing information, specifications, reference designs, etc.) are provided for information only and are subject to change without notice. Reasonable efforts have been made in the preparation of these documents to assure their accuracy, however Micro Modular Technologies Pte. Ltd. assumes no liability resulting from errors or omissions in this, or any document, or from the use of the information contained herein. Micro Modular Technologies Pte. Ltd. reserves the right to make changes in the product design and specifications as needed and without notification to its users. Please check our website for the most current documentation. All information contained herein is the property of Micro Modular Technologies Pte. Ltd. and may not be copied or reproduced, other than for your information, without prior written consent.

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