

MN5010HS

GPS Receiver Module

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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



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1.2 Block Diagram

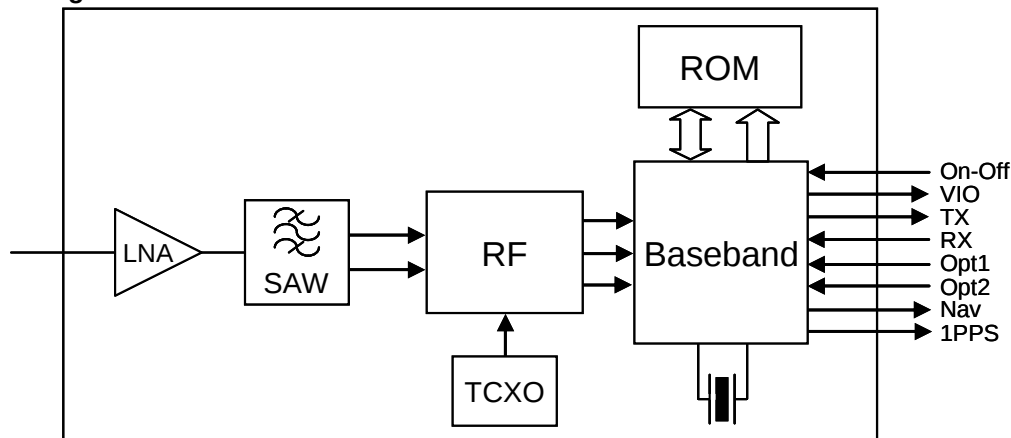


Figure 1 - MN5010HS Block Diagram

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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

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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

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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.

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3.3.3 Jamming Performance

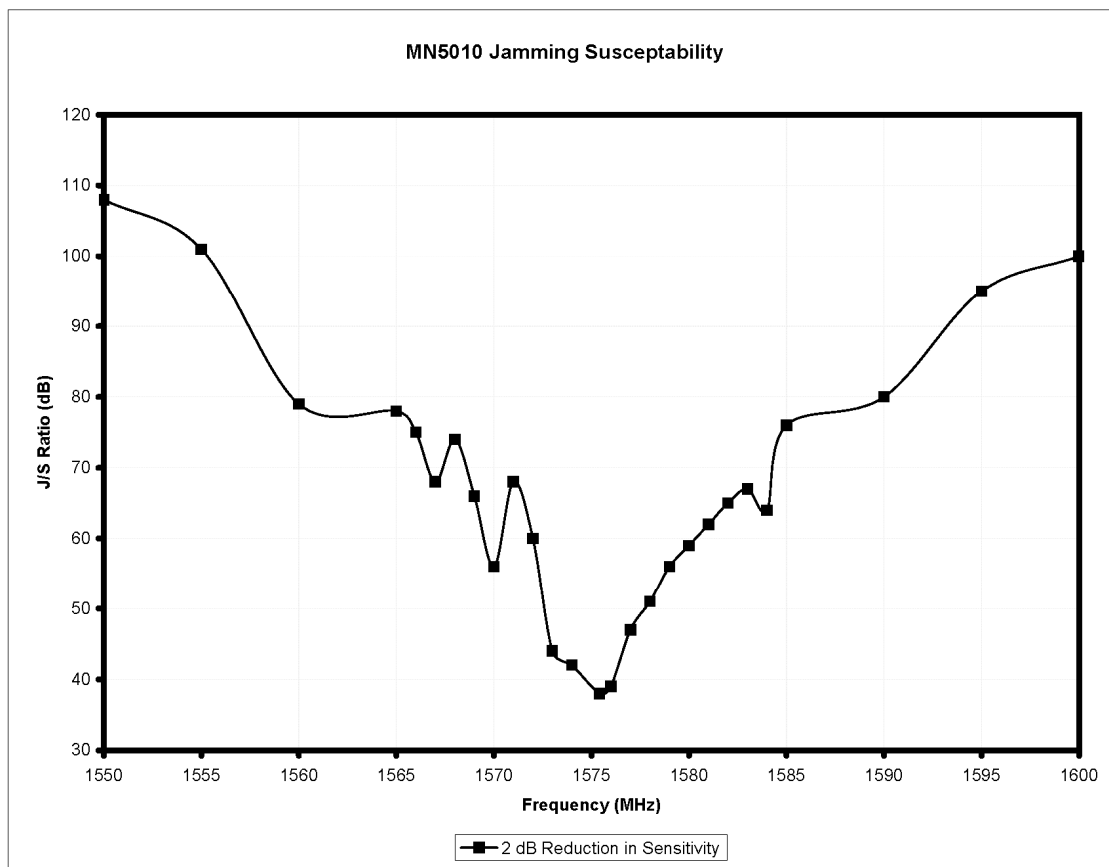


Figure 2 – Jamming Performance

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.

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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.

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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

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6 Packaging and Marking Information

6.1 Package Dimensions and Component Marking

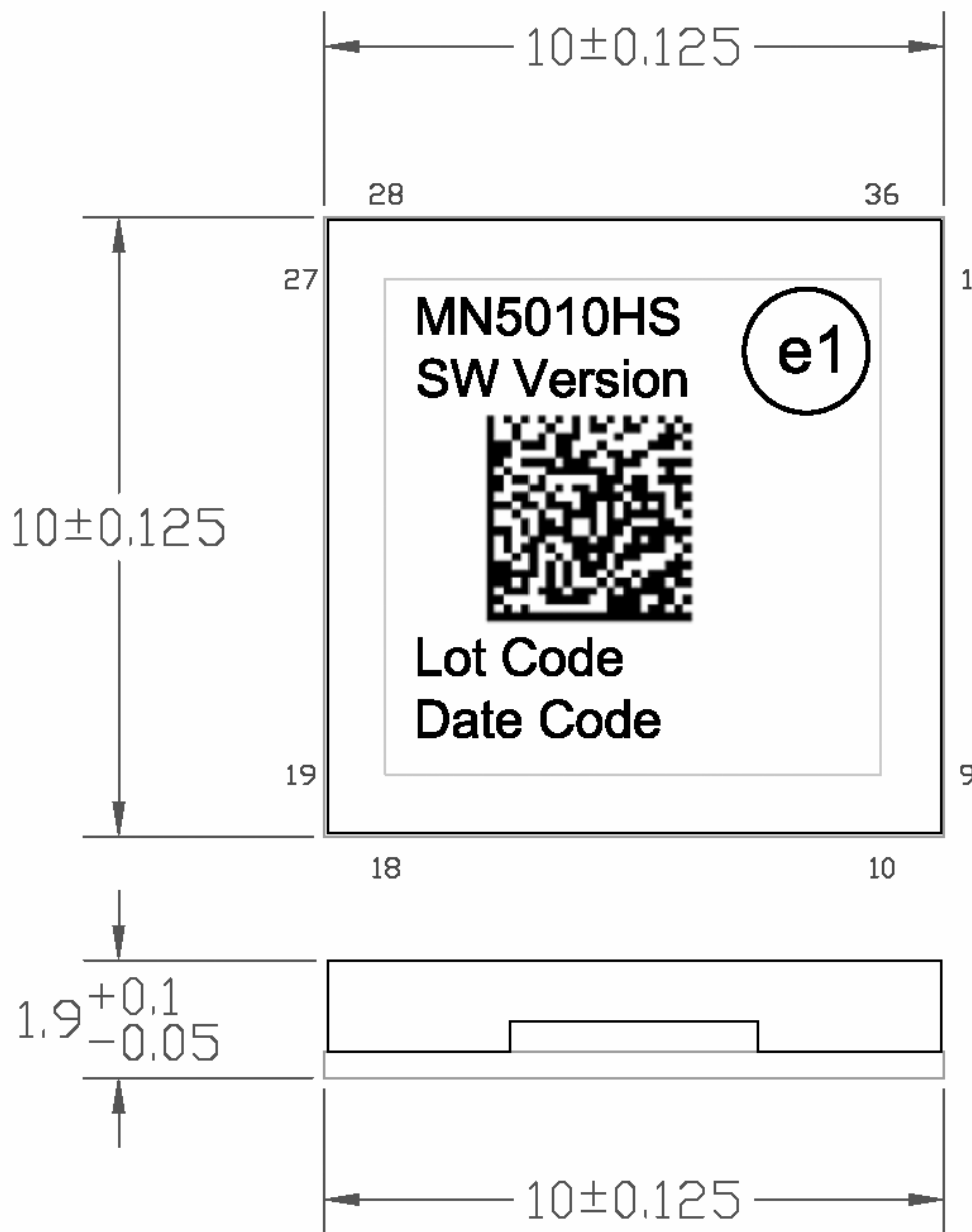


Figure 3 – Package Outline & Marking (in mm) : 36-pin LGA

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

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Technical drawing of a square plate with the following dimensions and tolerances:

- Overall width: 10 ± 0.125
- Overall height: 10 ± 0.125
- Inner square dimensions: 28 (width), 36 (height)
- Inner square corner radii: 27 (top-left), 19 (bottom-left), 18 (bottom-left), 10 (bottom-right)
- Inner square corner radii: 1 (top-right), 9 (bottom-right)
- Inner square corner radii: 0.5 (bottom-right)
- Inner square corner radii: 1 (bottom-left)
- Inner square corner radii: 0.5 (bottom-right)

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.

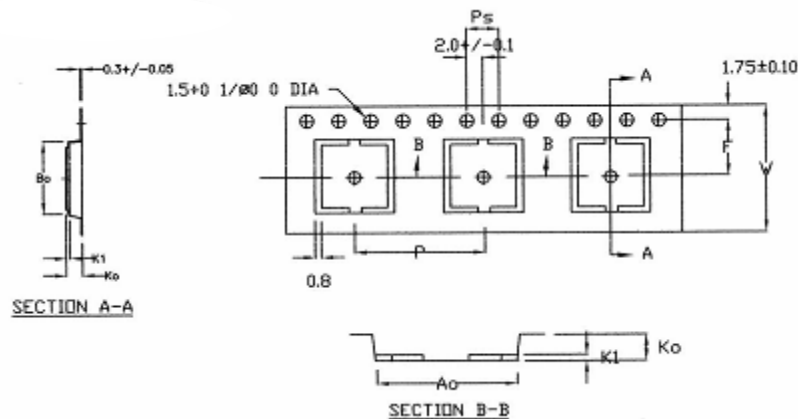
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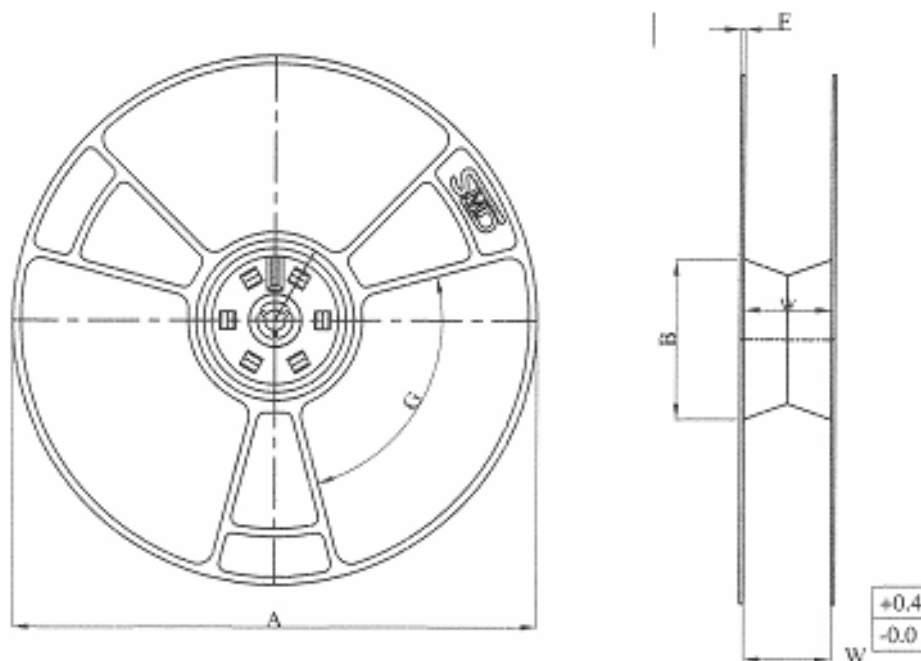
6.3 Tape and Reel Information

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)

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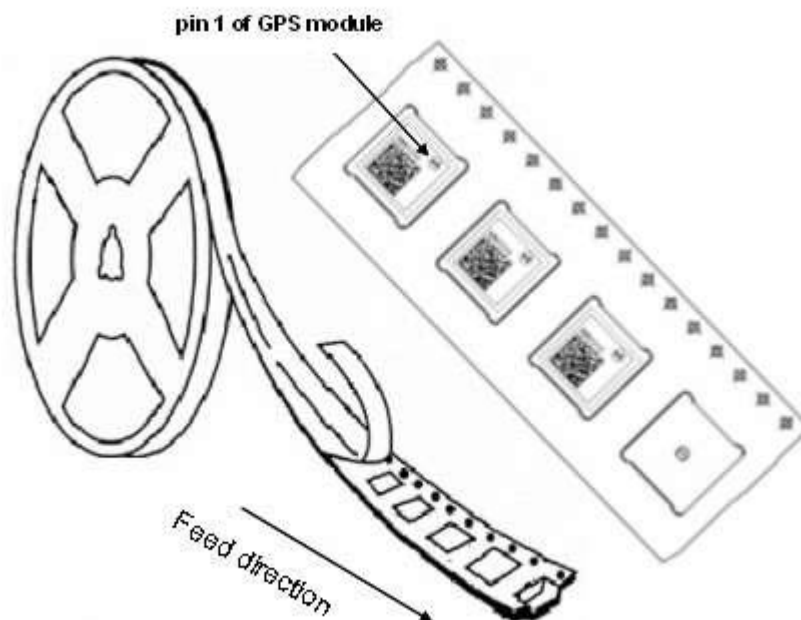


Figure 7 – Orientation in tape

6.4 Tube packaging

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

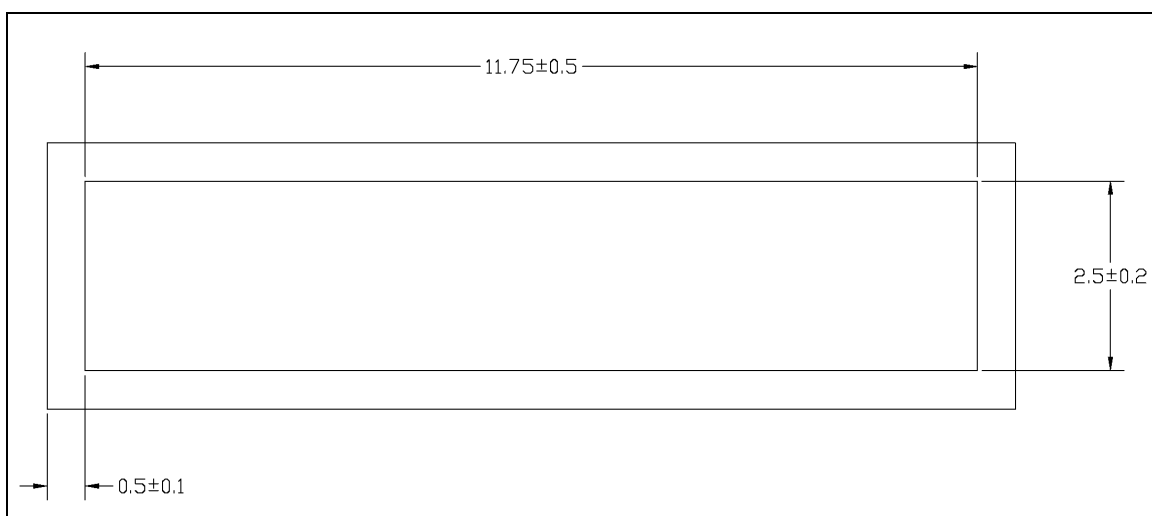


Figure 8 – Tube dimensions (in mm)

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6.5 Recommended Reflow Profile

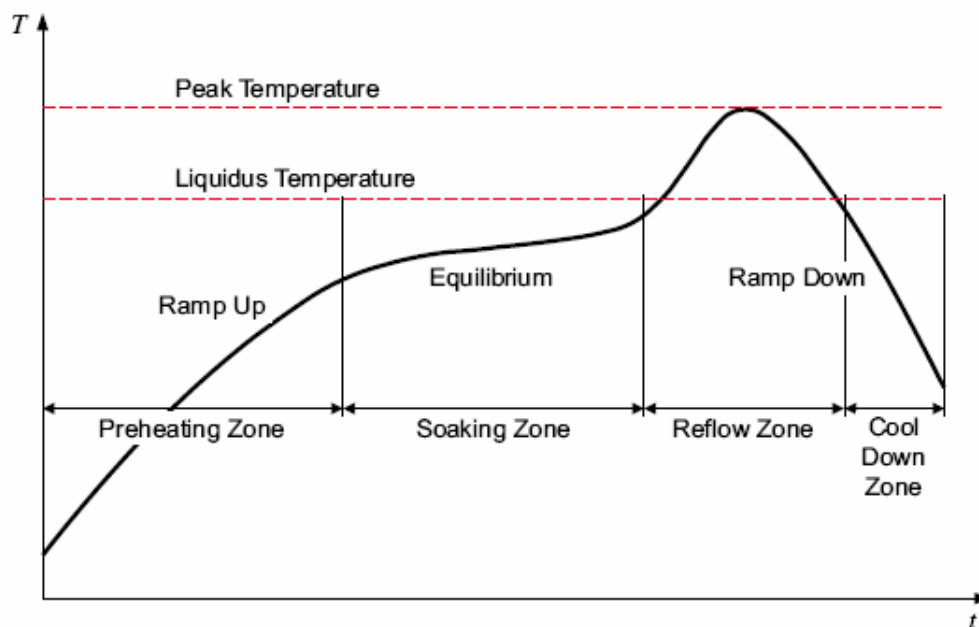


Figure 9 – Reflow Profile

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

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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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