MN5310HS/AHS
GPS Receiver Module

1 Description

The Micro Modular Technologies MN5310HS/AHS Global Positioning System (GPS) Receiver Module is a complete 20-channel receiver with high sensitivity intended for OEM applications. It features fast-acquisition hardware, integrated RF filtering, TCXO, real-time clock with on-board crystal, flash memory, 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 MN5310HS/AHS 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 MN5310HS/AHS operates from a single battery supply between 3.0 and 3.6 VDC. For even further power reductions, the OEM design may use a commanded power-saving mode.

The MN5310HS/AHS 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 SiRFstarIII-based 20-channel GPS receiver
- Highly integrated design includes on-board LNA, TCXO, RF filtering, and RTC circuit with crystal
- Small, 25.4 mm x 25.4 mm package
- Less than 80 mW typical power consumption
- Fast-acquisition design for rapid position determination under all startup and operating conditions.
- Full Industrial temperature operation (-40℃ to + 85℃ = MN5310HS)
- Supports active or passive antennas
- Standard serial protocols: NMEA-0183 or SiRF binary
- Supports SBAS (WAAS, EGNOS, MSAS, GAGAN)
- Extended Ephemeris upload capable
- Pb-free RoHS compliant

1.2 Block Diagram

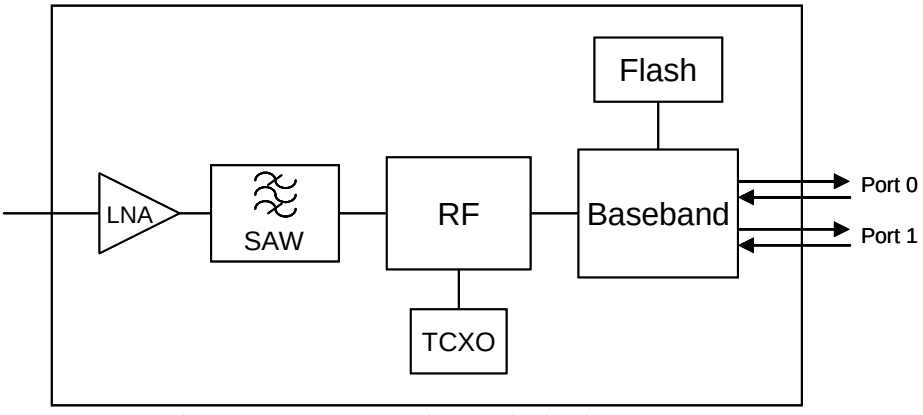


Figure 1 - MN5310HS/AHS Block Diagram

1.3 GPS Performance

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

Table 1 – Acquisition Performance

Horizontal Position Error	Accuracy
CEP	<2.5 meters

Table 2 – Positional Accuracy

Sensitivity	Typical
Tracking	-159 dBm
Acquisition (Cold Start)	-145 dBm

Table 3 – Sensitivity

2 Environmental Limits

2.1 Operating

Temperature	-40℃ to +85℃ (MN5310HS) -30℃ to +85℃ (MN5310AHS)
Humidity	Up to 95% non-condensing or a wet bulb temperature of +35℃, whichever is less
Altitude	-1000 feet to 60,000 feet

Table 4 – Operating Limits

2.2 Storage

Temperature	-40℃ to +85℃
Humidity	Up to 95% non-condensing or a wet bulb temperature of +35℃, 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 Limits

3 Electrical

3.1 Module Pin-out

Pin	Name	Pin Definition
1	VCC	Primary power supply to the module (+3.0 to +3.6 VDC).
2	GND	Ground.
3	BOOT	Boot select. If this pin is at logic 0 upon startup or reset, the MN5310HS/AHS will begin normal operation. If it is at logic 1, the module will enter the flash reprogramming mode. This pin should be tied to ground through a 0 Ω resistor.
4	RX0	The MN5310HS/AHS GPS Receiver Module implements two full-duplex asynchronous serial UART ports. This signal is the input for the first UART and is normally used to input commands to the receiver in either binary or NMEA format, depending upon the configuration of the receiver. In the idle condition, this pin is at logic 1. If the driving circuitry is powered independently of the MN5310HS/AHS, ensure that this pin is not driven to logic 1 when primary power to the MN5310HS/AHS is removed.
5	TX0	The MN5310HS/AHS GPS Receiver Module implements two full-duplex asynchronous serial UART ports. This signal is the output for the first UART and is normally used to output position, time and velocity information from the receiver in either binary or NMEA format, depending upon the configuration of the receiver. In the idle condition, this pin is at logic 1.
6	TX1	The MN5310HS/AHS GPS Receiver Module implements two full-duplex asynchronous serial UART ports. This signal is the output for the second UART. In the idle condition, this pin is at logic 1. In the default configuration, the software does not send data on this port.
7	RX1	The MN5310HS/AHS GPS Receiver Module implements two full-duplex asynchronous serial UART ports. This signal is the input for the second UART and may be used to input commands or additional information to the receiver. In the idle condition, this pin is driven at logic 1. If the driving circuitry is powered independently of the MN5310HS/AHS, ensure this pin is not driven to logic 1 when primary power to the MN5310HS/AHS is removed. In the default configuration, the software does not receive data on this port..
8	N/C	No-connect
9	N/C	No-connect
10	GND	Ground.
11	GND	Ground.
12	GND	Ground.
13	GND	Ground.
14	GND	Ground.
15	GND	Ground.
16	GND	Ground.
17	RFIN	RF Input. Connect to an antenna. See Section 3.3 (RF Interface).
18	GND	Ground.

Pin	Name	Pin Definition
19	VANT	Power supply to antenna. See section 3.3 (RF Interface).
20	VRF	2.85V source, may be used for antenna supply. VRF can supply a maximum of 15 mA. See Section 3.3 (RF Interface).
21	VBK	Backup battery supply. See section 3.2 (Power Supply).
22	N/C	No-connect
23	N/C	No-connect
24	N/C	No-connect
25	N/C	No-connect
26	ON-OFF	An input pulse toggles the state of the module between On and Hibernate. To toggle the state, pulse this pin high for a minimum of 1 ms. Maximum pulse rate is one per second.
27	N/C	No-connect
28	N/C	No-connect
29	1PPS	One-pulse-per-second (1PPS) output, synchronized when the fix is valid. The pulse duration is 1 µs, and its rate is 1 Hz. See section 3.4.3, 1PPS Signal.
30	GND	Ground.

Table 6 – MN5310HS/AHS Pin-out

3.2 Power Supply

The MN5310HS/AHS GPS Receiver Module is designed to operate from a single supply voltage applied to the VCC pin.

Voltage	3.0 to 3.6 VDC
Current (typical)	26 mA
Current (maximum)	30 mA

Table 7 – Main (VCC) Power Supply

The MN5310HS/AHS GPS Receiver Module will keep its internal RTC and battery backed SRAM alive when the main supply voltage is removed provided a backup supply voltage is applied to VBK. When VCC is present, VBK should not exceed VCC.

Voltage	3.0 to 3.6 VDC
Current (operating)	1.5 mA
Current (hibernating)	15 uA

Table 8 – Backup (VBK) Power Supply

If the backup feature of the internal RTC and the battery backed SRAM is not needed, VBK may be left unconnected.

3.3 RF Interface

3.3.1 RF Input

The MN5310HS/AHS GPS Receiver Module accepts a standard GPS L1 signal from an industry-standard antenna (which may be passive or active). If a passive antenna is used, no other circuitry is required and the VANT pin should be either left open or grounded.

If an active antenna is required, a DC voltage may be impressed upon the RF Input pad to supply power for the antenna. The VRF output pin 20 is a suitable 3-volt switched supply than can be tied to the VANT pin 19 to supply power to the active antenna via the RF Input pad.

Signal Level	-159 dBm to -125 dBm typical
Frequency	L1 (1575.42 MHz)
Return Loss	Better than -10 dB
Noise Figure	2 dB typical
Impedance	50 Ohms nominal

Table 9 – RF Signal Characteristics

The MN5310HS/AHS GPS Receiver Module has a noise figure of 2 dB typically. With high quality high gain passive antennas this will provide adequate performance provided the cable loss between the passive antenna and the MN5310HS/AHS is kept to a minimum.

3.3.2 Burnout Protection

The MN5310HS/AHS GPS Receiver Module can accept signal levels up to -20dBm with a DC voltage of ±15 V on the RF input pin without permanent damage to the module.

3.3.3 Jamming Performance

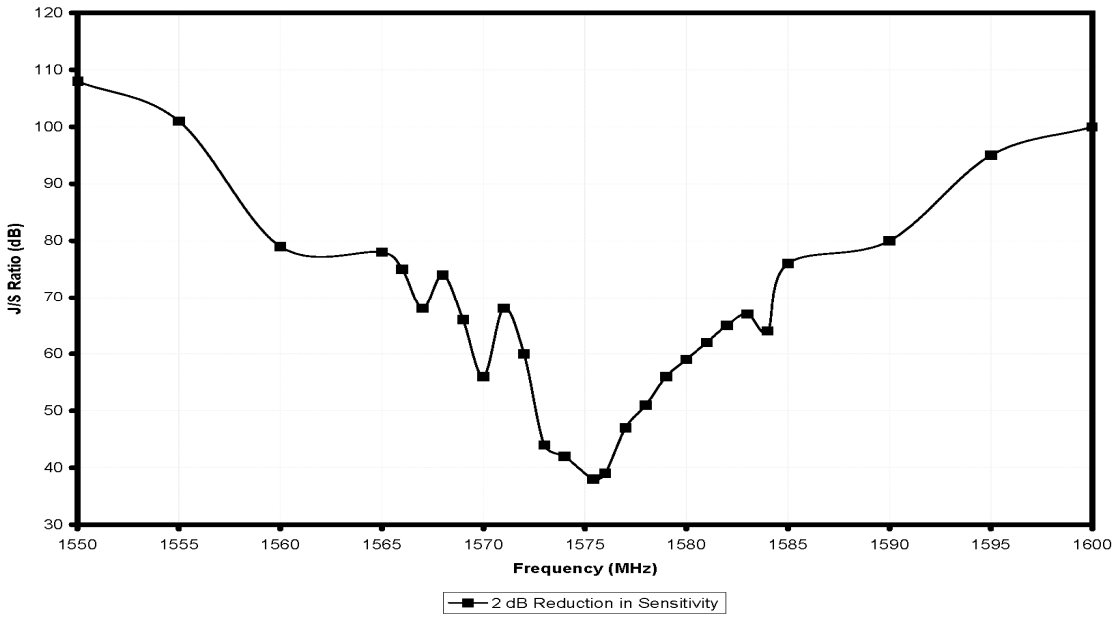


Figure 2 – Jamming Performance

3.4 Signal Interface

3.4.1 Digital Interface Levels

V_{DD} is nominally 2.85 VDC.

Parameter	Symbol	Min	Typ	Max	Units
High Level Input Voltage	V_{IH}	0.7*V_{DD}		V_{DD} +0.3	V
Low Level Input Voltage	V_{IL}	-0.3		0.3* V_{DD}	V
Switching Threshold	V_T		0.5* V_{DD}		V
High Level Input Current	I_{IH}	-10		10	uA
Low Level Input Current	I_{IL}	-10		10	uA
High Level Output Voltage	V_{OH}	V_{DD}-0.2			V
Low Level Output Voltage	V_{OL}			0.2	V

Table 10– Digital I/O Interface Levels

3.4.2 Serial Interface

Two serial data ports provide data communications to and from the MN5310HS/AHS GPS Receiver Module. In idle condition, these pins are at logic 1.

3.4.3 1PPS Signal

The 1PPS signal output is valid only when the receiver is in 3D navigation mode. The 1PPS signal pulses high for 1 microsecond at 1 Hz.

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

Table 11 – 1PPS Signal Characteristics

3.4.4 BOOT Signal

The BOOT pin must be tied to ground for normal operation. It is recommended to go through a zero Ω resistor to permit re-programming the flash memory if that should be required in the future. This pin must not be left floating.

4 Software Interface

4.1 NMEA Standard Output Messages

The MN5310HS/AHS supports the NMEA-018 v3.0 messages:

ID	Description	Default interval
GGA	GPS fix data	1 sec
GLL	Latitude and longitude	N
GSA	DOP and active satellites	1 sec
GSV	Satellites in view	5 sec
RMC	Recommended Minimum GNSS Data	1 sec
VTG	Course over ground and ground speed	N
ZDA	Time and date	N

Table 12 –NMEA Messages

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

4.2 NMEA Proprietary Commands

The MN5310HS/AHS 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 13 – Proprietary NMEA Commands

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

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

Table 14 – Referenced Documents

6 Packaging and Marking Information

6.1 Component Marking

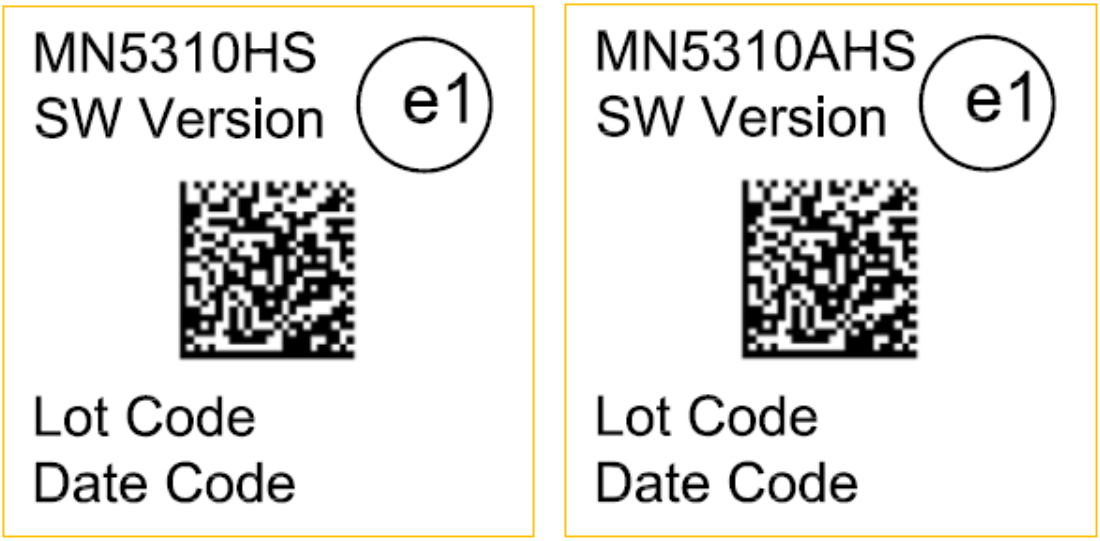


Figure 3 – Marking

Note the JEDEC Pb-free symbol is also used as the pin 1 identifier for the MN5310HS/AHS.

6.1.1 Date Code

The date code is contained in the fourth line of text. The first character shall be a number indicating the last digit of the year of manufacture, starting from 2005 to 2014. The second character shall be an alphanumeric character indicating the month of manufacture (see Table 15 – Date Code: Second Character (month indicator)). The third character shall be an alphanumeric character indicating the day of manufacture (see Table 16 – Date Code: Third Character (day indicator)).

1 = January	4 = April	7 = July	A = October
2 = February	5 = May	8 = August	B = November
3 = March	6 = June	9 = September	C = December

Table 15 – Date Code: Second Character (month indicator)

1 = 01	6 = 06	B = 11	G = 16	M = 21	T = 26
2 = 02	7 = 07	C = 12	H = 17	N = 22	U = 27
3 = 03	8 = 08	D = 13	J = 18	P = 23	W = 28
4 = 04	9 = 09	E = 14	K = 19	Q = 24	X = 29
5 = 05	A = 10	F = 15	L = 20	R = 25	Y = 30
					Z = 31

Table 16 – Date Code: Third Character (day indicator)

6.2 Packaging Drawing

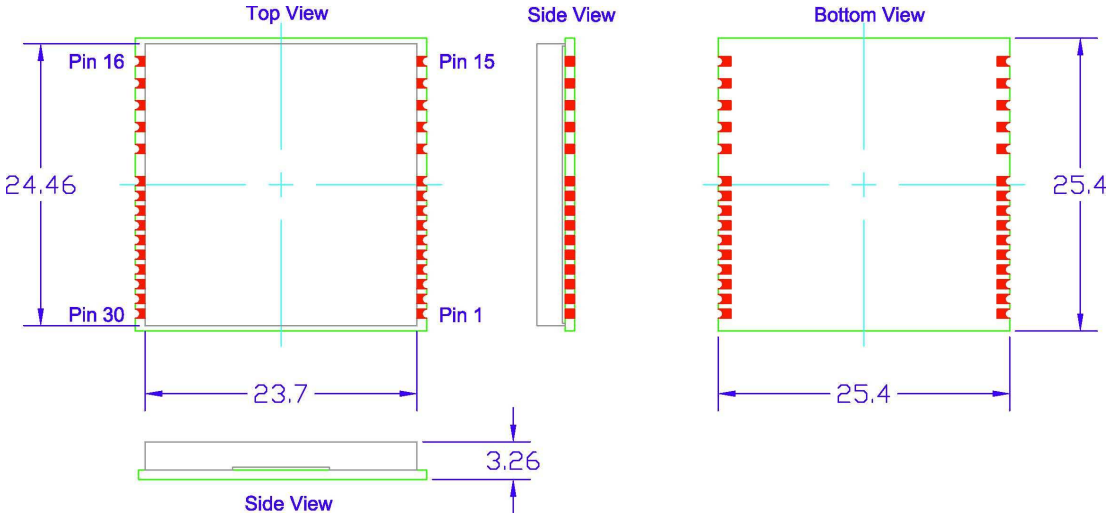


Figure 4 – Mechanical Outline

6.3 Recommended PCB Footprint

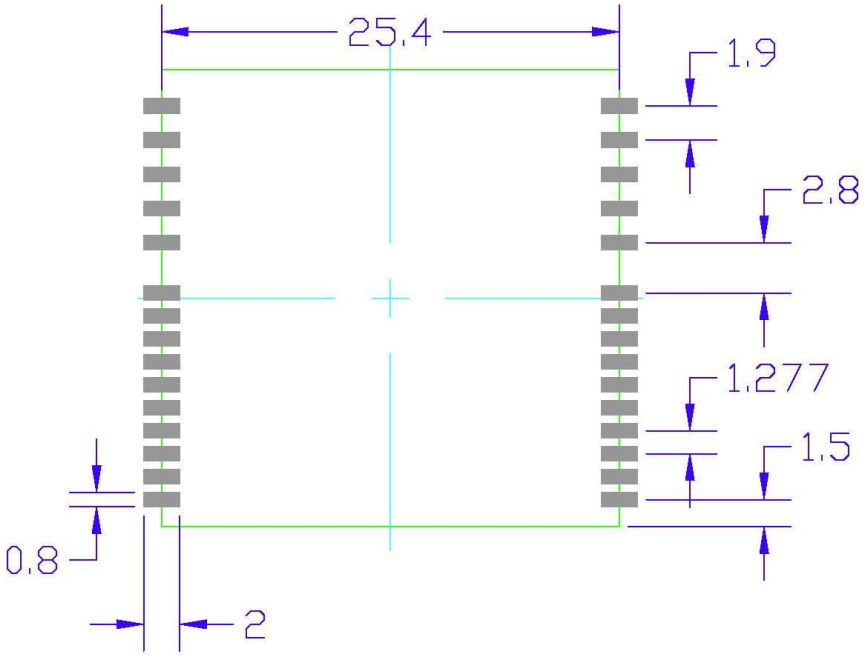
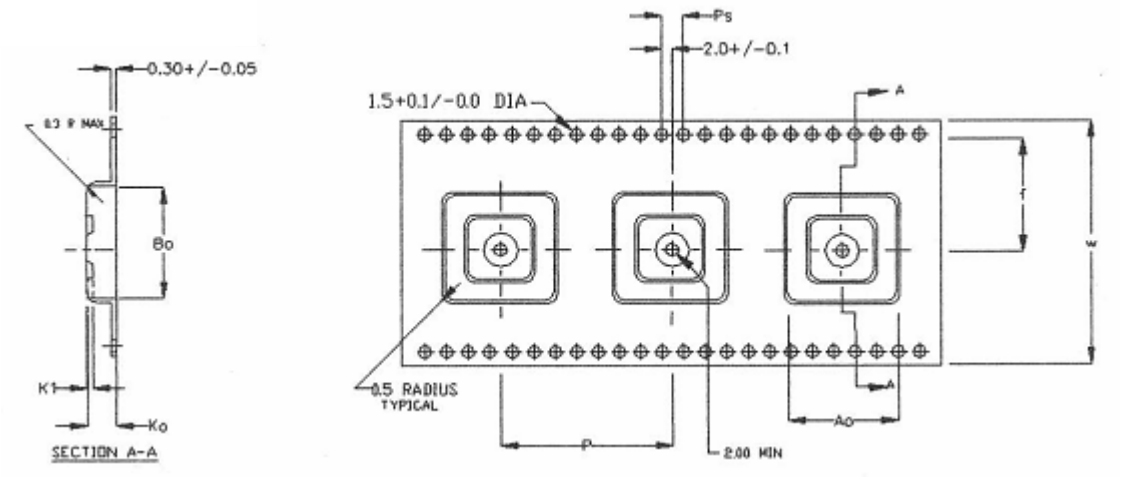


Figure 5 – Recommended PCB Footprint (View from Top)

Figure 5 is a suggested PCB footprint for the MN5310HS/AHS. The user may need to adjust the pad dimensions based upon their manufacturing process. While solder mask covered traces are permissible underneath the MN5310HS/AHS, exposed vias or pads should be avoided.

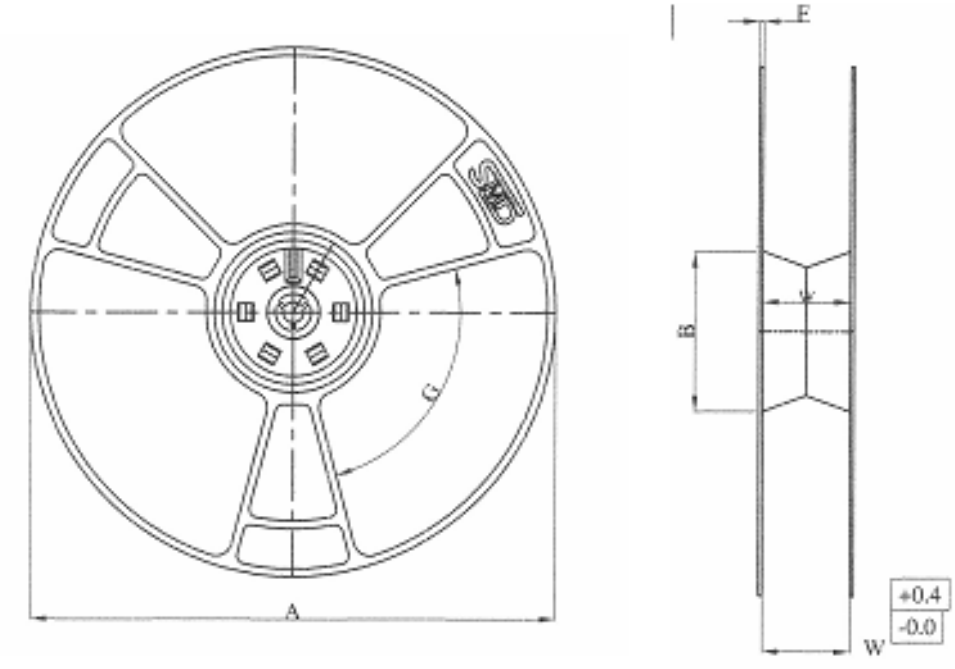
6.4 Tape and Reel Information

The MN5310HS/AHS is provided in standard tape and reel, with 300 devices per reel.



Dimensions	W	P	Ao	Bo	Ko	K1	Ps	F
Nominal	44.00	32.00	25.60	25.60	5.35	1.30	4.00	20.20
Tolerance	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Figure 6 – Carrier Tape Dimensions (in mm)



Reel Part No.	A	W	B	F	G
SMD/H4/W44	330	44.4	100	2.0	90°

Figure 7 – Reel Dimensions (in mm)

6.5 Recommended Reflow Profile

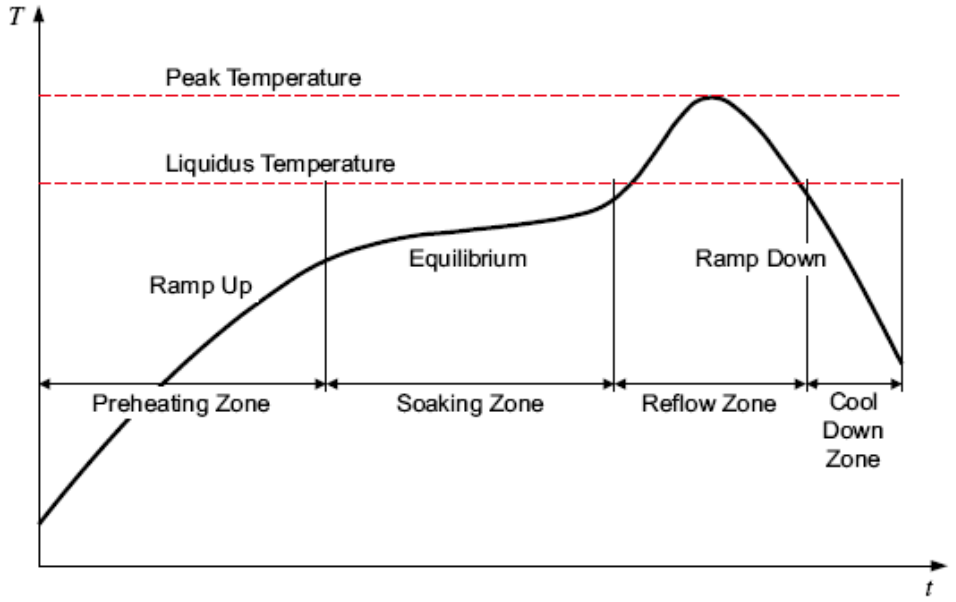


Figure 8 – Reflow Profile

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

Table 17 – Reflow Parameters

7 Ordering Information

The ordering part numbers are contained in the table below:

Ordering Part Number	Description
MN5310HS-RS	MN5310HS in tape & reel
MN5310HS-TS	MN5310HS in tube
MN5310AHS-RS	MN5310AHS in tape & reel
MN5310AHS-TS	MN5310AHS in tube

Table 18 – Ordering information

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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