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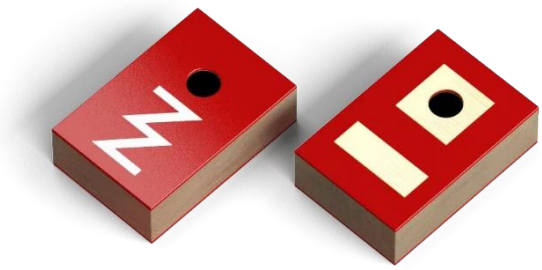
NANO mXTEND™

NN02-101

USER MANUAL

NANO mXTEND™: Versatility and Space efficiency in the smallest Virtual Antenna® component.

The **NANO mXTEND™** is the smallest Virtual Antenna® chip to date. Featuring a size of only 3 mm x 2 mm x 0.8 mm, this off-the-shelf chip antenna has been designed to fit almost every **IoT device** from entry-level to high-end products. The **NANO mXTEND™** is enabled by Virtual Antenna® technology, thus featuring the unique properties of this class of products: easy to use; versatile, and broadly tunable. The **NANO mXTEND™** is available for Bluetooth, Wi-Fi, Wi-SUN, and any wireless connectivity protocol operating from 2.4 GHz to 10.6 GHz. Due to Ignion's proprietary Virtual Antenna® technology, this chip antenna is non-resonant and therefore broadly tunable, enabling additional frequency bands to be supported by the same antenna part and released in the future.



NANO mXTEND™ component (NN02-101)

Most used industries.

- **Asset Tracking & Logistics.**
- **Consumer Electronics.**
- **Smart home.**

NANO mXTEND™ benefits.

- **Smallest clearance**: 5mm x 5mm.
- **Miniature:** Smallest Virtual Antenna™ form factor of 3.0 mm x 2.0 mm x 0.8 mm.
- **Versatile:** Can be mounted either on the device corner or on the center edge.
- **Reliability:** Off-the-Shelf standard product, no antenna part customization (electronic optimization).
- **Use cases:** smart home, tracking devices, wearables, gaming devices, IoT modules.

Operation bands summary.

Bluetooth and Wi-Fi (2.4 GHz – 2.5 GHz).
UWB (3.1 GHz – 8.5 GHz)

CHAPTER INDEX

1 CONFIGURATION OVERVIEW

The NANO mXTEND™ has been designed for **Bluetooth/Wi-Fi** and **UWB** connectivity**.** Due to its versatility, the chip antenna component can be mounted both on the corner or on the center of an edge of the printed circuit board (PCB) of your wireless device just by changing the matching network. Additionally, the NANO mXTEND™ provides connectivity at **UWB** bands 1 - 3 and 5 - 9. The table below includes a quick reference guide for the antenna specifications.

Configuration	Frequency range	Frequency Regions
BLUETOOTH/Wi-Fi	2.4 – 2.5 GHz	1
UWB	3.1 – 4.8 GHz, 6.0 – 8.5 GHz	2

Table 1 - List of communication standards included in this user manual sorted by frequency range.

The following table presents the technical specifications of the NANO mXTEND™ antenna booster, including its radiation pattern, polarization, weight, temperature range, impedance, and dimensions. These features make the NANO mXTEND™ antenna booster a highly versatile and durable component that can be easily integrated into a wide range of wireless applications.

Technical Features	NANO mXTEND™ (NN02-101)
Radiation Pattern	Omnidirectional
Polarization	Linear
Weight (approx.)	0.01 g
Temperature	-40 to + 125 ºC
Impedance	50 Ω

Table 2 - Technical features for the NANO mXTEND™.

PURCHASE EVALUATION BOARD THROUGH DISTRIBUTOR

Any of the evaluation boards shown in this document can be purchased through our main distributors, find them here: https://ignion.io/distributors/.

1.1. BLUETOOTH/Wi-Fi

Technical Specs for the NANO mXTEND™ in the corner configuration:

Technical features	2400 – 2500 MHz
Average Efficiency	>55 %
Peak Gain	2.4 dBi
VSWR	< 2.5:1

Table 3 - Performance of NANO mXTEND™ configured for Bluetooth/Wi-Fi in the corner on evaluation board (80 mm x 40 mm x 1 mm).

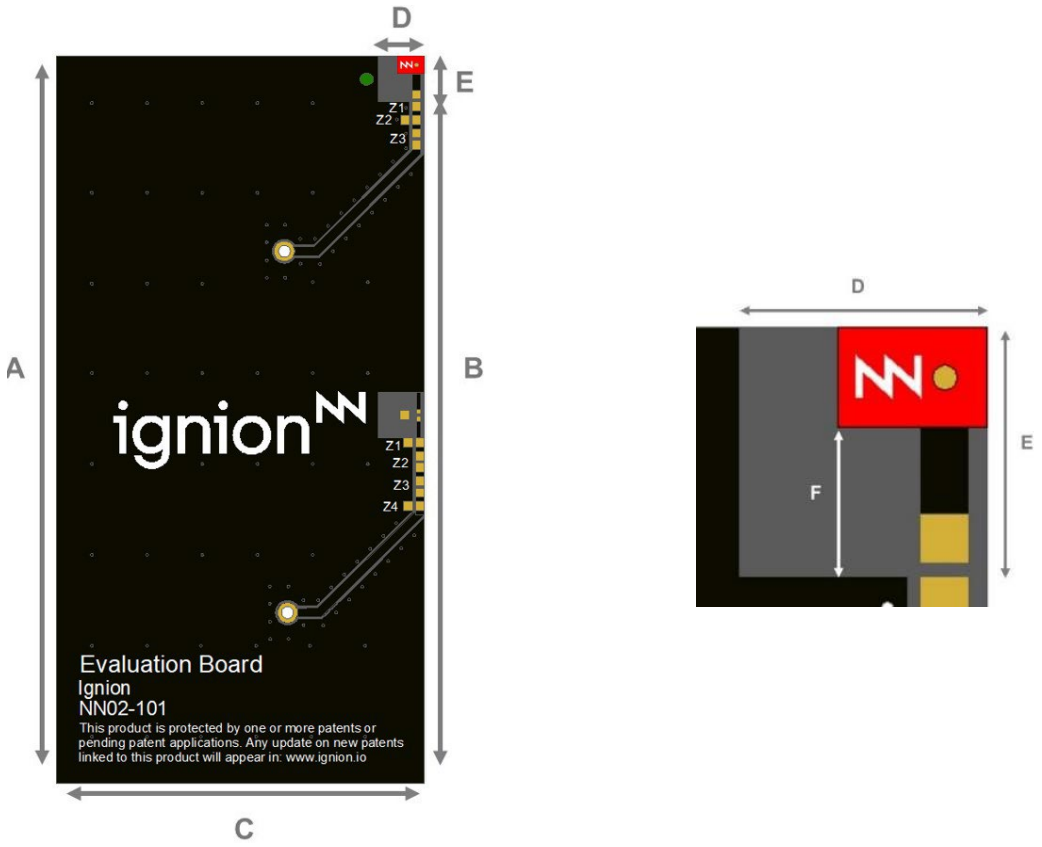
Technical Specs for the NANO mXTEND™ in the edge configuration:

Technical features	2400 – 2500 MHz
Average Efficiency	>65 %
Peak Gain	2.4 dBi
VSWR	< 3.0:1

Table 4 - Performance of NANO mXTEND™ configured for Bluetooth/Wi-Fi in the edge on evaluation board (80 mm x 40 mm x 1 mm).

1.2. CORNER MOUNTING CONFIGURATION

The NANO mXTEND™ is ready for corner mounting in those devices where this region is available for antenna placement. This section details a corner mounting design on a reference ground plane of 80 mm x 40 mm including a clearance area of 5 mm x 5 mm **(Figure 1)**. Other ground plane sizes and clearances can be implemented by adapting the matching network.



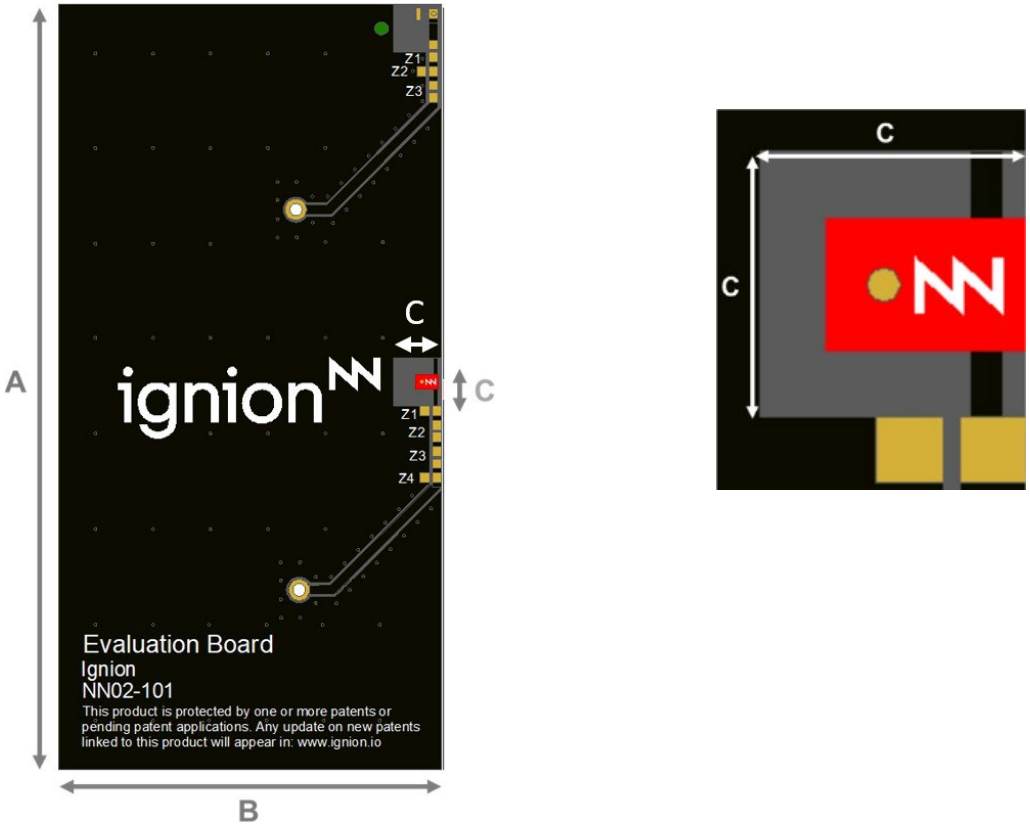
Measure	mm
A	80
B	75
C	40
D	5
E	5
F	3

Tolerance: ±0.2 mm

Figure 1 – EB_NN02-101_c_BT. Evaluation board configured to provide operation at Bluetooth (2.4 GHz – 2.5 GHz).

1.3. EDGE MOUNTING CONFIGURATION

The NANO mXTEND™ is ready for edge mounting in those devices where this region is available for antenna placement. This section details an edge mounting design on a reference ground plane of 80 mm x 40 mm including a clearance area of 5 mm x 5 mm (Figure 2). Other ground plane sizes and clearances can be implemented by adapting the matching network.



Measure	mm
A	80
B	40
C	5

Tolerance: ±0.2 mm

C: Length of clearance area.

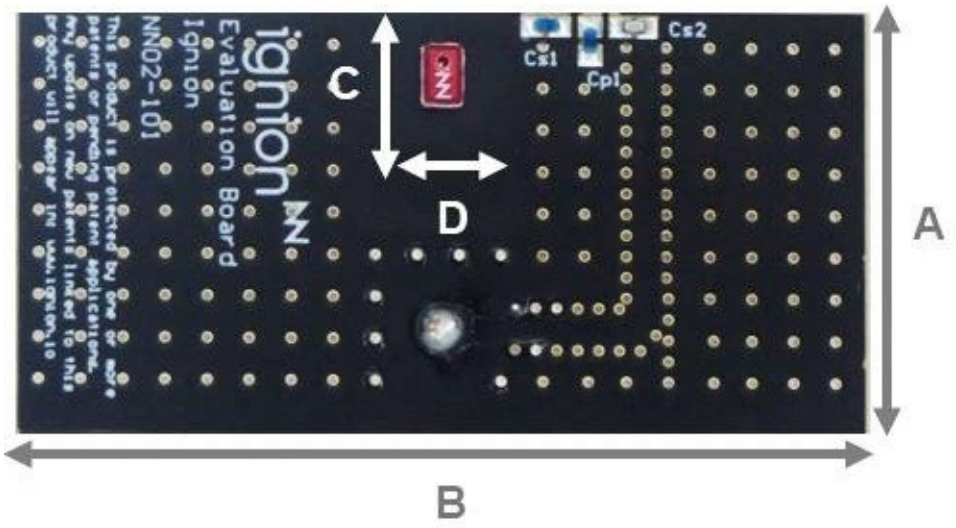
Figure 2 - EB_NN02-101_m_BT. Evaluation board providing operation at Bluetooth (2.4 GHz – 2.5 GHz).

1.4. UWB BANDS 1 – 3

Technical features	UWB (LFR)
	3.1 – 4.8 GHz
Average Efficiency	77%
Peak Gain	3.6 dBi
VSWR	< 2.6:1

Table 5 - Performance of NANO mXTEND™ configured for UWB bands 1 - 3 on evaluation board (40 mm x 20 mm x 1 mm).

The Evaluation Board EB_NN02-101-UWB-LFR integrates the NANO mXTEND™ antenna component to provide operation in the frequency region from 3.1 GHz to 4.8 GHz, through a single input/output port.



Measure	mm
A	20.0
B	40.0
C	10.0
D	7.6

Tolerance: ±0.2 mm

Material: The Evaluation Board is built on a very Low-Loss Laminate substrate (FR-4 process compatible). Thickness is 0.8 mm.

Clearance Area: 10.0 mm x 7.6 mm (B x C)

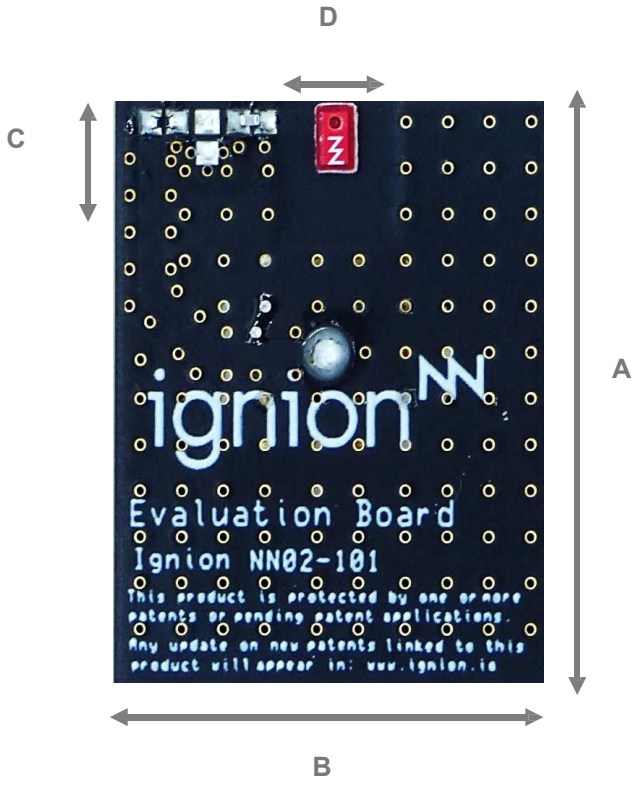
Figure 3 – EB_NN02-101-UWB-LFR. Evaluation Board providing operation at UWB (from 3.1 GHz to 4.8 GHz).

1.5. UWB BANDS 5 – 9

Technical features	UWB (HFR)
	6.0 – 8.5 GHz
Average Efficiency	70.4%
Peak Gain	3.1 dBi
VSWR	< 3:1

Table 6 - Performance of NANO mXTEND™ configured for UWB bands 5 – 9 on evaluation board (25 mm x 20 mm x 1 mm).

The Evaluation Board EB_NN02-101-UWB-HFR integrates the NANO mXTEND™ antenna component to provide operation in the frequency region from 6.0 GHz to 8.5 GHz, through a single input/output port.



Measure	mm
A	25.0
B	20.0
C	6.0
D	6.0

Tolerance: ±0.2 mm

Material: The Evaluation Board is built on a very Low-Loss Laminate substrate (FR-4 process compatible). Thickness is 0.8 mm.

Clearance Area: 6.0 mm x 6.0 mm (C x D)

Figure 4 – EB_NN02-101-UWB-HFR. Evaluation Board providing operation at UWB (from 6.0 GHz to 8.5 GHz).

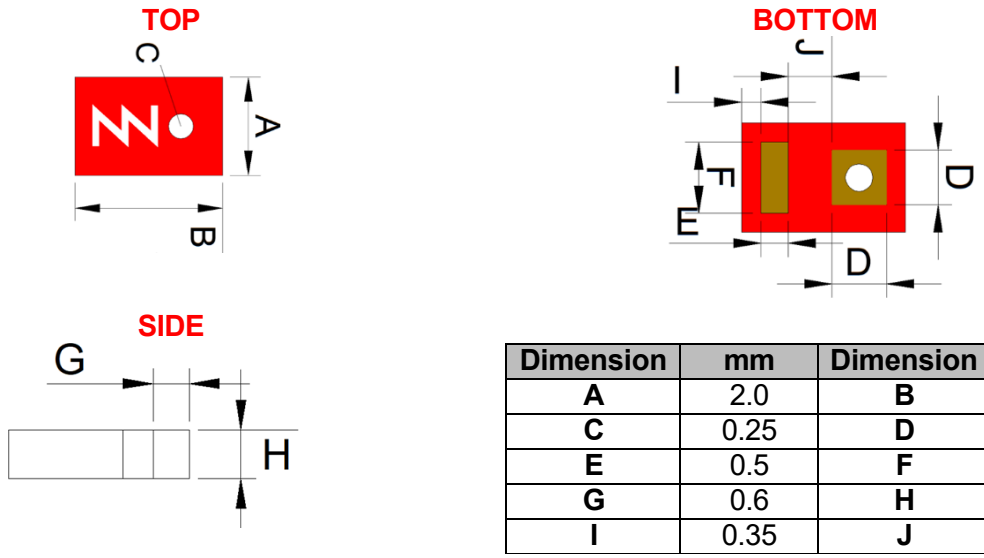
1.6. ASSESS YOUR OWN DEVICE REQUIREMENTS

If you are designing a device with a different size or operating frequency than shown above, you can assess the performance of this configuration using our free-of-charge Oxion™ platform. This tool provides a complete design report, including expected performance and tailored design guide, within 24 hours. For additional information about Ignion's range of R&D services, please visit: https://ignion.io/resources-support/technical-center/engineering-support/. If you require further assistance, please contact support@ignion.io.

Purchase this or other evaluation boards through our main distributors by visiting the following link: https://ignion.io/distributors/.

2 MECHANICAL SPECIFICATIONS

2.1 DIMENSIONS, TOLERANCES, AND RoHS



Dimension	mm	Dimension	mm
A	2.0	**B**	3.0
C	0.25	**D**	1.0
E	0.5	**F**	1.3
G	0.6	**H**	0.8
I	0.35	**J**	0.8

Figure 5 - NANO mXTEND™ antenna booster dimensions and tolerances.

The NANO mXTEND™ (NN02-101) antenna booster is compliant with the restriction of the use of hazardous substances (**RoHS**). For more information, please contact info@ignion.io.

The **RoHS** certificate can be downloaded from https://ignion.io/files/RoHS_NN02-101.pdf.

2.2 SPECIFICATIONS FOR THE INK

The next figure shows the range of colors in the NANO mXTEND™ antenna booster:

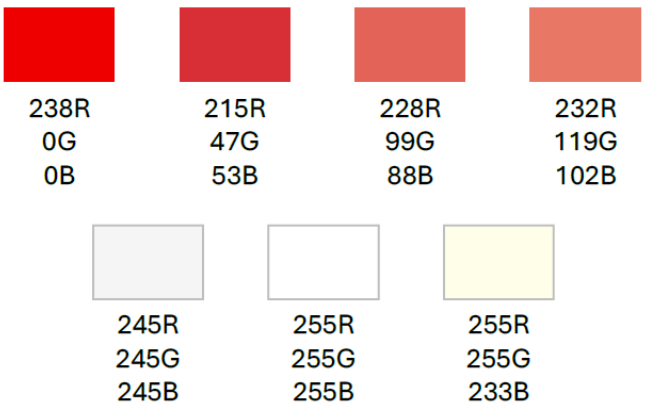


Figure 6 – Acceptable color range.

3 ASSEMBLY AND MANUFACTURING

Figure 7 shows the back and front views of the NANO mXTEND™ (NN02-101) antenna booster.

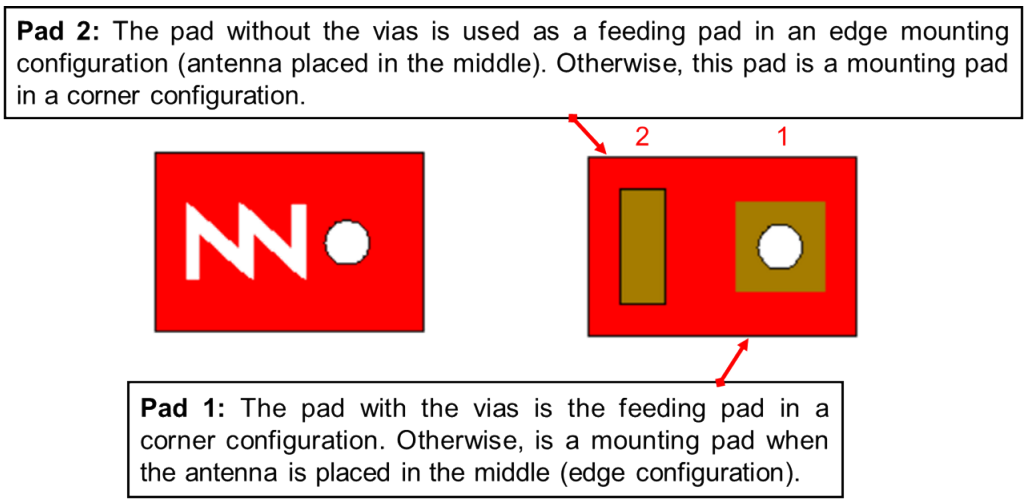


Figure 7 – Pads of the NANO mXTEND™ (NN02-101) antenna booster

As a surface mount device (SMD), the NANO mXTEND™ antenna booster is compatible with industry standard soldering processes. The basic assembly procedure for the NANO mXTEND™ antenna booster is as follows:

1. Apply a solder paste on the pads of the PCB. Place the NANO mXTEND™ antenna booster on the board.
2. Perform a reflow process according to the temperature profile detailed in Figure 9.
3. After soldering the NANO mXTEND™ antenna booster to the circuit board, perform a cleaning process to remove any residual flux. Ignion recommends conducting a visual inspection after the cleaning process to verify that all reflux has been removed.

The drawing below shows the soldering details obtained after a correct assembly process:

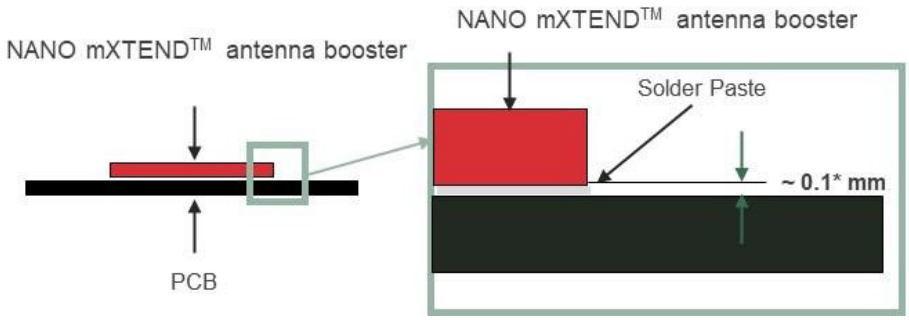


Figure 8 – Soldering Details.

NOTE(*): Solder paste thickness after the assembly process will depend on the thickness of the soldering stencil mask. A stencil thickness equal to or larger than 127 microns (5 mils) is required.

The NANO mXTEND™ (NN02-101) antenna booster can be assembled following the Pb-free assembly process. According to the **IPC/JEDEC J-STD-020C** Standard, the suggested temperature profile is as follows:

Phase	Profile features	Pb-Free Assembly (SnAgCu)
RAMP-UP	Avg. Ramp-up Rate (Tsmax to Tp)	3 ºC / second (max.)
PREHEAT	- Temperature Min (Tsmin) - Temperature Max (Tsmax) - Time (tsmin to tsmax)	150 ºC 200 ºC 60-180 seconds
REFLOW	- Temperature (TL) - Total Time above TL (tL)	217 ºC 60-150 seconds
PEAK	- Temperature (Tp) - Time (tp)	260 ºC 20-40 seconds
RAMP-DOWN	Rate	6 ºC/second max
Time from 25 ºC to Peak Temperature		8 minutes max

Table 7 - Recommended soldering temperatures.

The next graphic shows the temperature profile (grey zone) for the NANO mXTEND™ antenna booster assembly process reflow ovens.

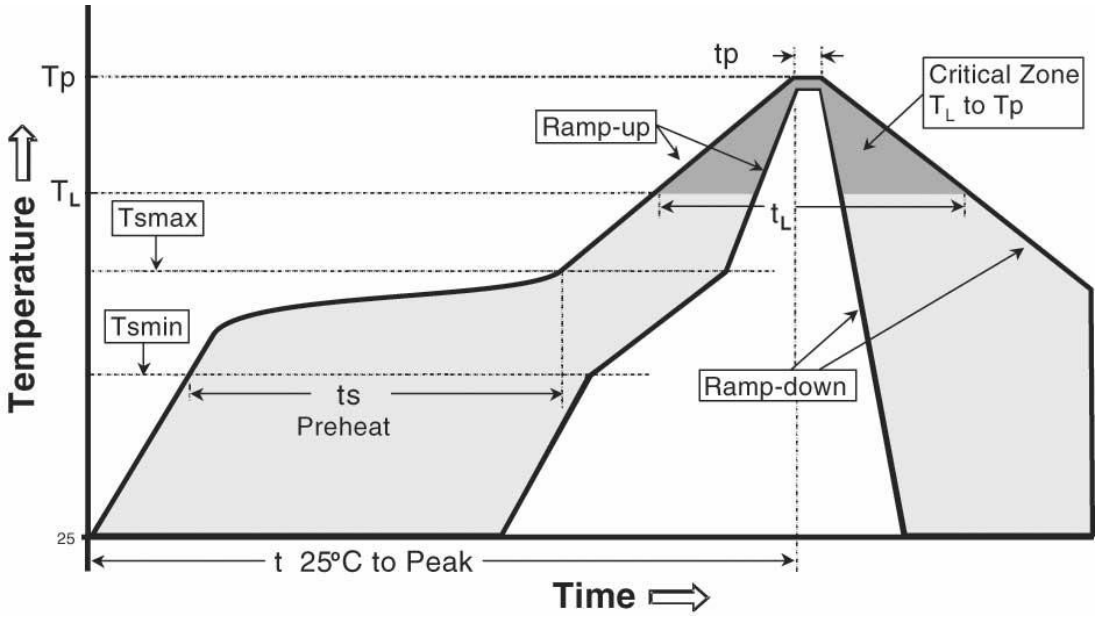
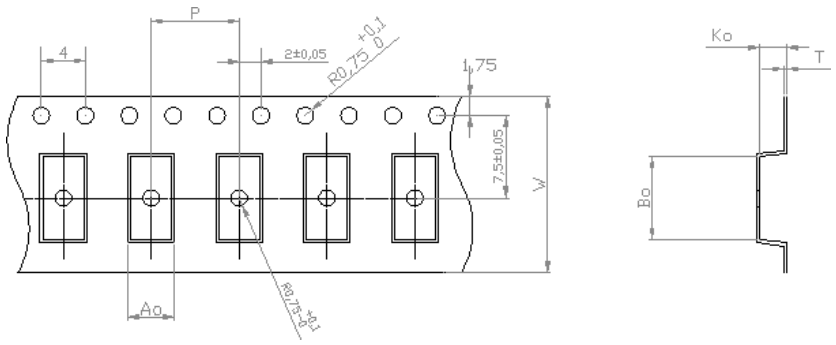


Figure 9 – Temperature profile.

4 PACKAGING

The NANO mXTEND™ (NN02-101) antenna booster is delivered in tape and reel packaging. Ambient room conditions according to Moisture Sensitivity Level (MSL3): floor life is limited to 168 hours at ≤ 30 °C / 60% RH. If this limit is exceeded, components must be baked following the JEDEC J-STD-033 standard before solder reflow to remove absorbed moisture.



Measure	mm
A0	3.6 ± 0.1
B0	7.5 ± 0.1
K0	2.5 ± 0.1
W	16.0 ± 0.3
P	8.0 ± 0.1
T	0.3 ± 0.05

Figure 10 - Tape dimensions and tolerances.

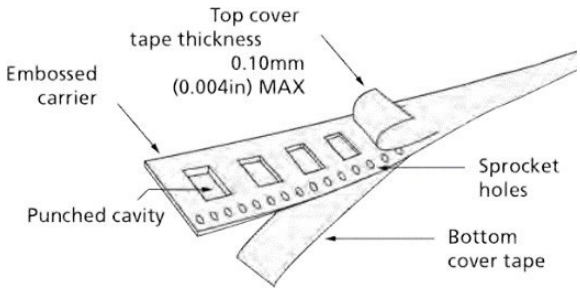
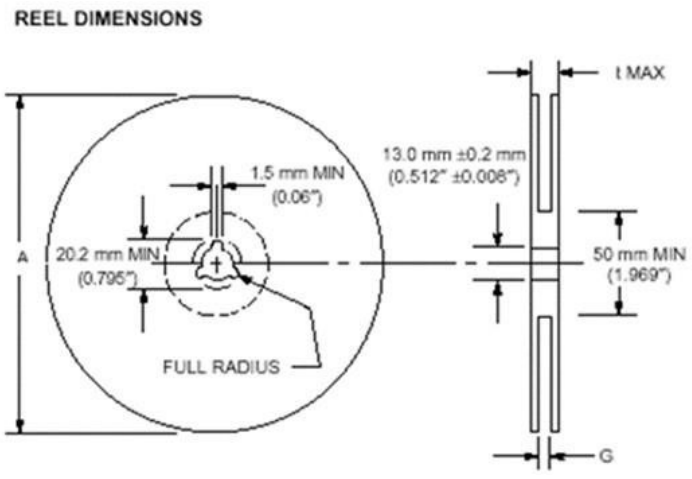


Figure 11 - Image of the tape.



Measure	mm
A	330 ± 1.0
G	16.4 ± 0.1
tMAX	20.4 ± 0.1

Reel Capacity: 2500 pcs

Figure 12 – Reel Dimensions and Capacity.

5 EASY DESIGN JOURNEY WITH VIRTUAL ANTENNA® TECHNOLOGY

This is the simple step by step design journey when designing with Virtual Antenna® technology. You can either do it yourself or you can leverage Ignion's comprehensive support. Our team of experts is available throughout every step, from feasibility to certification and can help ensure you get the antenna right.

Figure 13 – Virtual Antenna® design journey for a successful IoT solution.

Step 1 - Feasibility: The Antenna Intelligence Cloud™ provides feasibility results on a bare PCB in terms of reflection coefficient, total efficiency, and design recommendations such as antenna placement and clearance area.

Step 2 - Build design file: Build the design files (Gerber files) with optimal antenna integration based on Ignion templates and design recommendations received from the Antenna Intelligence Cloud™.

Step 3 - EM simulation: Validation of the design files with an Electro-Magnetic (EM) simulation of the full device considering every component, ensuring project requirements are met. Further allowing evaluation of design changes and their impact to the antenna performance.

Step 4 - Final Gerber design file sanity check: Check done by Ignion free of charge, ensuring that the antenna, matching network layout and other design recommendations on the final Gerber file follows the design guidelines before manufacturing.

Step 5 - Produce prototype and test: Verify performance results are aligned with expectations, easily fine-tune matching network if needed.

Step 6 - Certification pre-test: Perform OTA tests to ensure the device is meeting certification requirements.

Ignion is an ISO 9001:2015 certified company. All our antennas are lead-free and RoHS compliant.

ISO 9001: 2015 Certified

6 ANNEX: List of bands

6.1 Bluetooth/Wi-Fi bands covered

Comm. Standard	Frequency (MHz)	# band
Bluetooth/Wi-Fi	2400 - 2500	single band

6.2 UWB bands covered

Channels	Frequency (MHz)	System
1 – 3	3100 - 4800	UWB
5 – 9	6000 - 8500	UWB

CHANGE LOG

Publication date	Change description
April 2024	Document rebranding
December 2025	Section 2.2 - SPECIFICATIONS FOR THE INK Added 238R 0G 0B under the acceptable color range Added a changelog section for traceability and version control.

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