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DUO mXTEND[™]

NN03-320

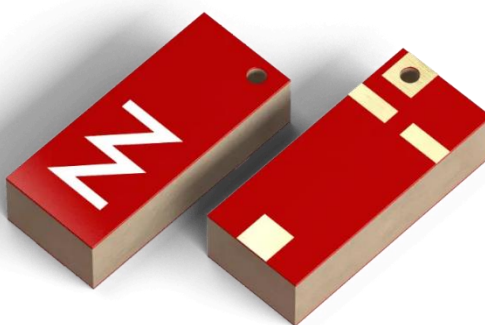
USER MANUAL

DUO mXTEND[™]: Highly versatile and powerful.

The **DUO mXTEND[™]** is a dual-port, chip antenna component designed to embed up to **two independent radios** in the smallest antenna footprint. Due to its Virtual Antenna[®] technology, the DUO mXTEND[™] can feature many other wireless services, such as UWB making it the ideal antenna part for **indoor/outdoor tracking devices**. Moreover, the component has been designed for **dual mounting**: either at the *center edge* of your device or at a *corner*, making this antenna *flexible* and *easy* to adapt to in a variety of devices and radio configurations.

TOP

BOTTOM

DUO mXTEND[™] component (NN03-320)

Most used industries.

- **Asset Tracking & Logistics**
- **Wearables & Hearables**
- **Smart Metering**
- **Smart City**

DUO mXTEND[™] benefits.

- **Multipurpose:** Multiband and multi-RAT IoT chip antenna component with 2 independent ports
- **Smallest clearance:** No clearance beyond the antenna footprint.
- **Miniature:** Small form factor of 7.0 mm x 3.0 mm x 2.0 mm.
- **Best for Combining:** One or more GNSS, Bluetooth, WiFi Dual Band, UWB and 5G applications.
- **Versatile:** Dual mounting on device corner or center edge.
- **Reliability:** Off-the-Shelf standard product, no antenna part customization (electronic optimization).

Operation bands summary.

GNSS, Bluetooth, 5G, UWB, WiFi Dual Band, and many more within the frequency range of 1500 MHz to 10600 MHz.

CHAPTER INDEX

1	CONFIGURATION OVERVIEW	4
	PURCHASE EVALUATION BOARD THROUGH DISTRIBUTOR	4
1.1.	GNSS AND BLUETOOTH IN A SINGLE PACKAGE	5
	EVALUATION BOARD FOR GNSS/BLUETOOTH DUAL SOLUTION	5
1.2.	THE DUO mXTEND™ FOR 5G	6
	EVALUATION BOARD FOR 5G	6
1.3.	THE DUO mXTEND™ FOR UWB	7
	EVALUATION BOARD UWB	7
1.4.	THE DUO mXTEND™ FOR WI-FI DUAL BAND	8
	EVALUATION BOARD WI-FI dual band	8
	ASSESS YOUR OWN DEVICE REQUIREMENTS	9
2	MECHANICAL SPECIFICATIONS	10
2.1	DIMENSIONS, TOLERANCES, AND RoHS	10
2.2	SPECIFICATIONS FOR THE INK	10
3	ASSEMBLY AND MANUFACTURING	11
4	PACKAGING	13
5	EASY DESIGN JOURNEY WITH VIRTUAL ANTENNA® TECHNOLOGY	14
6	ANNEX: List of bands	16
6.1	GNSS bands covered	16
6.2	Bluetooth/Wi-Fi bands covered.	16
6.3	5G bands covered.	16
6.4	UWB bands covered	16

1 CONFIGURATION OVERVIEW

The DUO mXTEND[™] antenna booster has been specifically designed for providing worldwide Global Navigation Satellite Systems (GNSS) and Bluetooth (BT) performance in wireless devices with small space requirements. Here we will compare BeiDou, GPS & Galileo and GLONASS performance operating in conjunction with Bluetooth. Using one of our Evaluation Boards, an example of a common DUO mXTEND[™] placement is seen. Additionally, other two solutions of 5G and UWB were provided.

Configuration	Frequency range	Frequency Regions
<u>GNSS + BLUETOOTH</u>	1561MHz, 1575MHz, 1598MHz to 1606MHz, and 2400MHz to 2500MHz.	4
<u>GNSS</u>	1561 MHz, 1575 MHz, 1598MHz to 1606MHz	3
<u>BLUETOOTH</u>	2400 MHz to 2500 MHz	1
<u>5G</u>	3400 MHz to 3800 MHz	1
<u>UWB</u>	3100 MHz to 4800 MHz	1
<u>WIFI DUAL BAND</u>	2400MHz to 2500MHz, 4900MHz to 5900MHz	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 DUO mXTEND[™] antenna booster, including its radiation pattern, polarization, weight, temperature range, impedance, and dimensions. These features make the DUO mXTEND[™] antenna booster a highly versatile and durable component that can be easily integrated into a wide range of wireless applications.

Technical Features	DUO mXTEND [™] (NN03-320)
Radiation Pattern	Omnidirectional
Polarization	Linear
Weight (approx.)	0.11 g.
Temperature	-40 to +125 °C
Impedance	50 Ω

Table 2 - Technical features for the DUO 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. GNSS AND BLUETOOTH IN A SINGLE PACKAGE

This Evaluation Board (part number: EB_NN03-320-m-GNSS-BT) integrates one DUO mXTEND™ antenna booster to provide operation in four frequency regions, 1561MHz (BeiDou E1 band), 1575 MHz (GPS L1 band and GALILEO E1), from 1598 MHz to 1606 MHz (GLONASS L1 band) and from 2400 MHz to 2500MHz (Bluetooth). A couple of UFL cables connect this dual input/output port solution to the SMA connectors for testing purposes.

Technical features	BeiDou	GPS & GALILEO	GLONASS	Bluetooth
	1561MHz	1575MHz	1598 – 1606MHz	2400 – 2500MHz
Average Efficiency	> 40%	> 45%	> 50%	> 50%
Peak Gain	-1.1 dBi	-1.0 dBi	-1.0 dBi	-0.9 dBi
VSWR	< 3:1			

Table 3 - Performance of DUO mXTEND™ configured for GNSS and Bluetooth on evaluation board (80 mm x 40 mm x 1 mm).

EVALUATION BOARD FOR GNSS/BLUETOOTH DUAL SOLUTION

This Evaluation Board (part number: EB_NN03-320-m-GNSS-BT) integrates one DUO mXTEND™ antenna booster to provide operation in four frequency regions, 1561MHz (BeiDou E1 band), 1575 MHz (GPS L1 band and GALILEO E1), from 1598 MHz to 1606 MHz (GLONASS L1 band) and from 2400 MHz to 2500MHz (Bluetooth). A couple of UFL cables connect this dual input/output port solution to the SMA connectors for testing purposes.

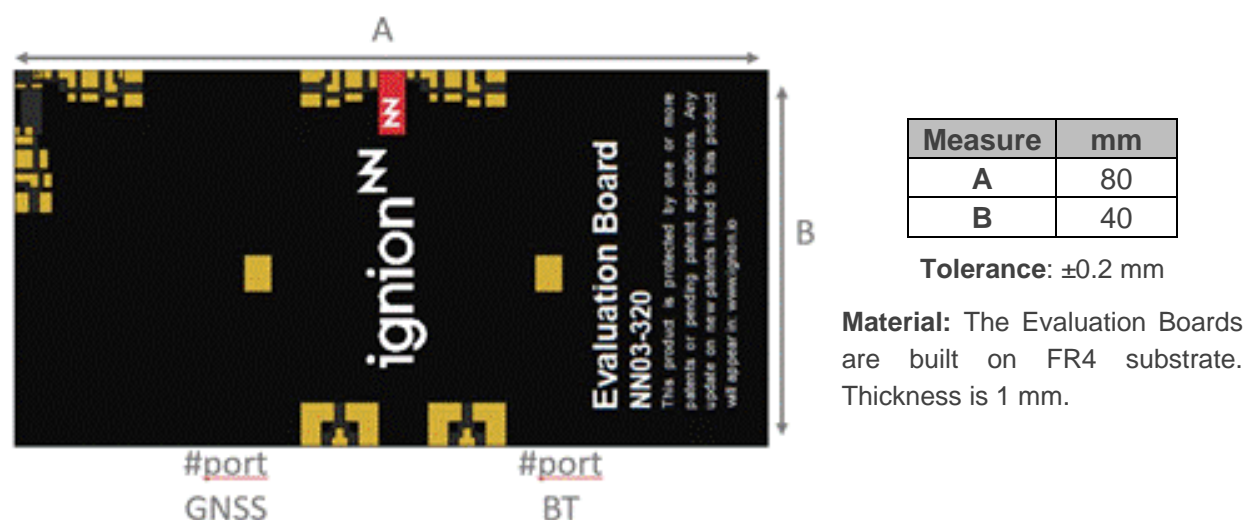


Figure 1 – EB_NN03-320-m-GNSS-BT Evaluation Board providing operation at BeiDou E1 band (1561 MHz), GPS L1 band and GALILEO E1 band (1575 MHz), GLONASS L1 band (from 1598 MHz to 1606 MHz) and Bluetooth (from 2400MHz to 2480MHz). Notice that the clearance area is equal to the DUO mXTEND™'s footprint.

1.2. THE DUO mXTEND™ FOR 5G

In this use case the DUO mXTEND™ antenna booster is operating at 5G (3.4 GHz - 3.8 GHz) and is integrated at the center edge of the Evaluation Board. A single matching network is selected allowing us to test, obtain, and analyze the VSWR, total efficiency, gain and radiation patterns. In the following design example, the DUO mXTEND™ antenna booster does **not** require further **clearance area beyond** its 7 mm x 3 mm **footprint**.

Technical features	3.4 – 3.8 GHz
Average Efficiency	> 60%
Peak Gain	2.6 dBi
VSWR	< 3.0:1

Table 4 - Performance of DUO mXTEND™ configured for 5G on evaluation board (80 mm x 40 mm x 1 mm).

EVALUATION BOARD FOR 5G

This Evaluation Board EB_NN03-320-m-5G integrates a UFL cable to connect the DUO mXTEND™ antenna booster with the SMA connector. The DUO mXTEND™ provides operation in the frequency region going from 3.4 GHz to 3.8 GHz (5G band), through a single input/output port.

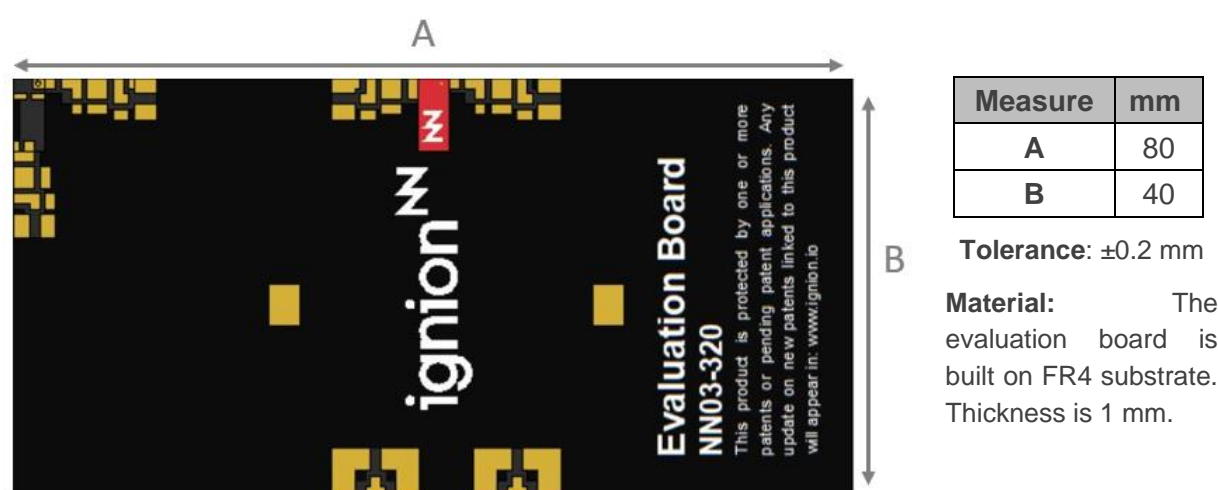


Figure 2 – EB_NN03-320-m-5G. Evaluation Board providing operation at 5G band (from 3.4 GHz to 3.8 GHz). Notice that the clearance area is equal to the DUO mXTEND™ footprint.

1.3. THE DUO mXTEND[™] FOR UWB

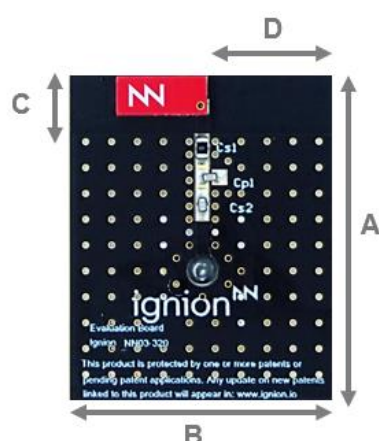
The DUO mXTEND[™] can be used to operate at **UWB** channels 5 and 9 in a single port configuration, ranging from: **6.0 GHz up to 8.5 GHz**.

Technical features	UWB (HFR)
	6.0 – 8.5 GHz
Average Efficiency	77%
Peak Gain	4.1 dBi
VSWR	< 2.5:1

Table 5 - Performance of DUO mXTEND[™] configured for UWB on evaluation board (25 mm x 20 mm x 1 mm).

EVALUATION BOARD UWB

The Evaluation Board EB_NN03-320-UWB-HFR integrates the DUO 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	5.0
D	10.0

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: 20.0 mm x 5.0 mm (B x C)

Figure 3 – EB_NN03-320-UWB-HFR. Evaluation Board providing operation at UWB (from 6.0 GHz to 8.5 GHz).

1.4. THE DUO mXTEND[™] FOR WI-FI DUAL BAND

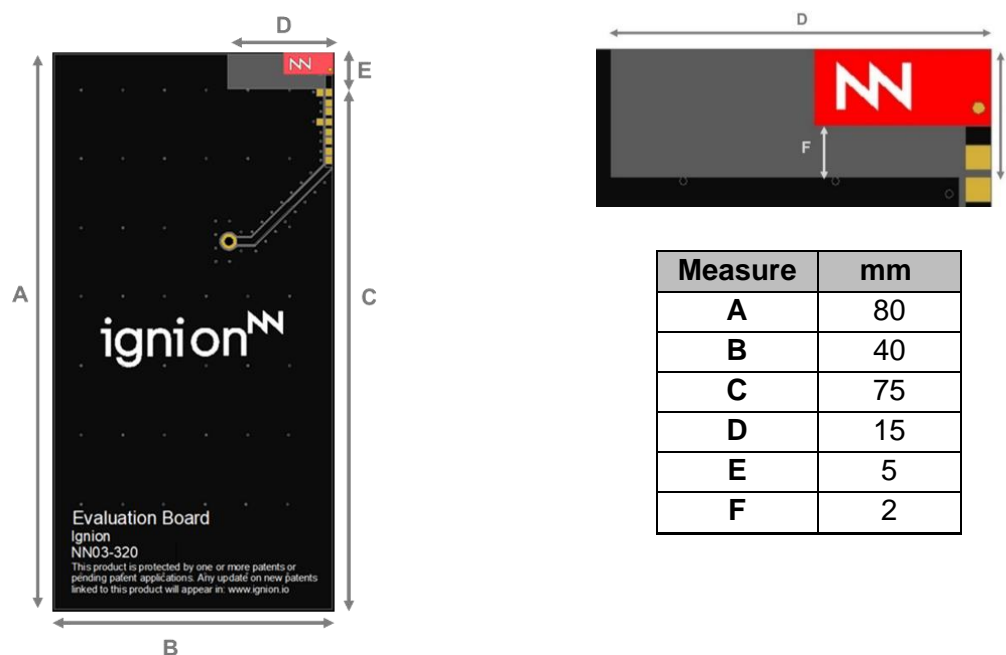
The DUO mXTEND[™] can be used to operate at **Wi-Fi dual band** in a single port configuration, ranging from: **2.4 GHz to 2.5 GHz and from 4.9 GHz to 5.875 GHz**.

Technical features	2.4 – 2.5 GHz	4.9 – 5.875 GHz
Average Efficiency	> 65%	> 65%
Peak Gain	4.1 dBi	3.8 dBi
VSWR	< 2.0:1	< 3.0:1

Table 6 - Performance of DUO mXTEND[™] configured for Wi-Fi dual band on evaluation board (80 mm x 40 mm x 1 mm).

EVALUATION BOARD WI-FI dual band

The Evaluation Board EB-NN03-320-C-WF integrates the DUO mXTEND[™] antenna booster to provide operation in the frequency region going from 2.4 GHz to 2.5 GHz and 4.9GHz to 5.875 GHz, through a single input/output port.



Tolerance: ± 0.2 mm

F: Distance between the DUO mXTEND[™] antenna booster and the ground plane.

Material: The evaluation board is built on FR4 substrate. Thickness is 1 mm.

Clearance Area: 15 mm x 5.0 mm (DxE)

Figure 4 - EB-NN03-320-C-WF. Evaluation Board providing operation at WiFi Dual Band from 2.4 GHz to 2.5 GHz and 4.9GHz to 5.875 GHz.

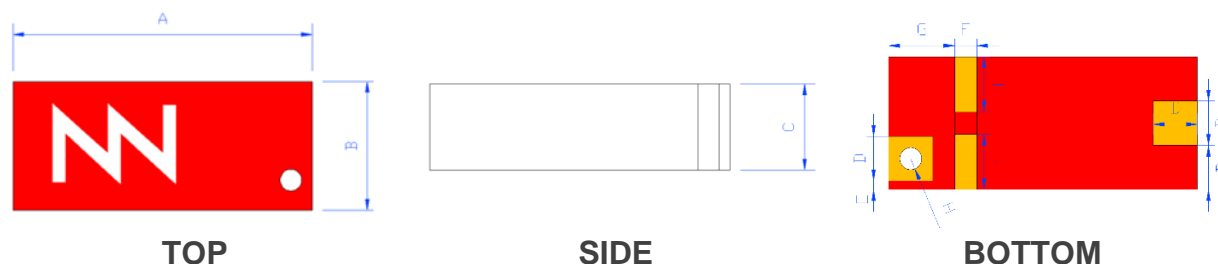
ASSESS YOUR OWN DEVICE REQUIREMENTS

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 platform 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	7.0 ± 0.2	B	3.0 ± 0.2
C	2.0 ± 0.1	D	1.0 ± 0.15
E	0.2 ± 0.1	F	0.5 ± 0.1
G	1.5 ± 0.1	H	R0.25 ± 0.1
I	1.25 ± 0.1		

Table 7 – DUO mXTEND[™] antenna booster dimensions and tolerances.

The DUO mXTEND[™] (NN03-320) 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_NN03-320.pdf.

2.2 SPECIFICATIONS FOR THE INK

The next figure shows the range of colors in the DUO mXTEND[™] antenna booster:




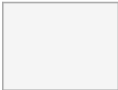


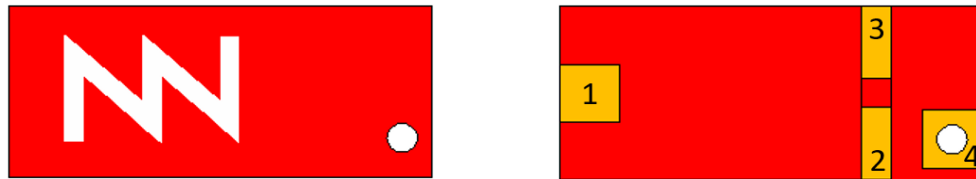
		
215R 47G 53B	228R 99G 88B	232R 119G 102B
		
245R 245G 245B	255R 255G 255B	255R 255G 233B

Figure 5 – Acceptable color range.

3 ASSEMBLY AND MANUFACTURING

Figure 6 shows the back and front views of the DUO mXTEND[™] (NN03-320) antenna booster.



Pin 1: Mounting pad. This pad is not grounded.

Pin 2: Grounding pad.

This MUST be connected to ground when the **Pin 3** is the feeding pad.

Pin 3 and 4: Feeding pads available for single/multi-port configurations.

Figure 6 – Pads of the DUO mXTEND[™] (NN03-320) antenna booster

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

1. Apply a solder paste on the pads of the PCB. Place the DUO mXTEND[™] antenna booster on the board.
2. Perform a reflow process according to the temperature profile detailed in Table 9, Figure 20.
3. After soldering the DUO 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:

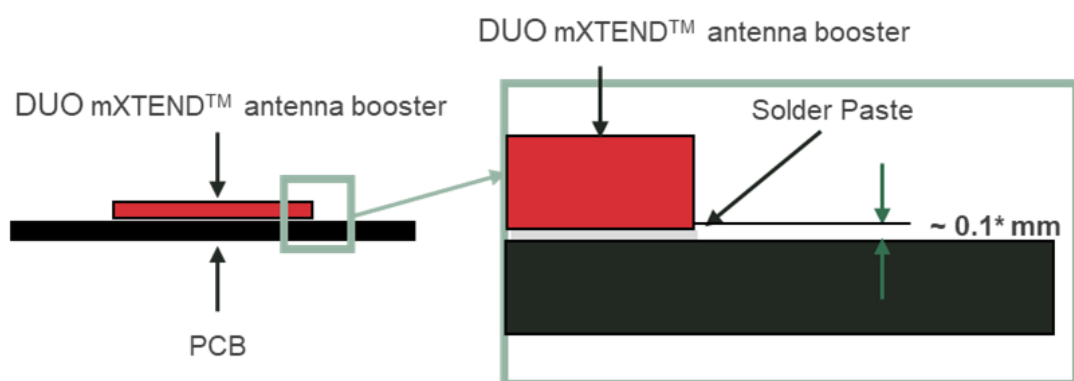


Figure 7 – Soldering Details.

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 DUO mXTEND[™] (NN03-320) antenna booster can be assembled following the Pb-free assembly process. According to the Standard **IPC/JEDEC J-STD-020C**, the temperature profile suggested is as follows:

Phase	Profile features	Pb-Free Assembly (SnAgCu)
RAMP-UP	Avg. Ramp-up Rate (T _{smax} to T _p)	3 °C / second (max.)
PREHEAT	<ul style="list-style-type: none"> - Temperature Min (T_{smin}) - Temperature Max (T_{smax}) - Time (t_{smin} to t_{smax}) 	150 °C 200 °C 60-180 seconds
REFLOW	<ul style="list-style-type: none"> - Temperature (T_L) - Total Time above T_L (t_L) 	217 °C 60-150 seconds
PEAK	<ul style="list-style-type: none"> - Temperature (T_p) - Time (t_p) 	260 °C 20-40 seconds
RAMP-DOWN	Rate	6 °C/second max
Time from 25 °C to Peak Temperature		8 minutes max

Table 8 - Recommended soldering temperatures.

Next graphic shows temperature profile (grey zone) for the DUO mXTEND[™] antenna booster assembly process reflow ovens.

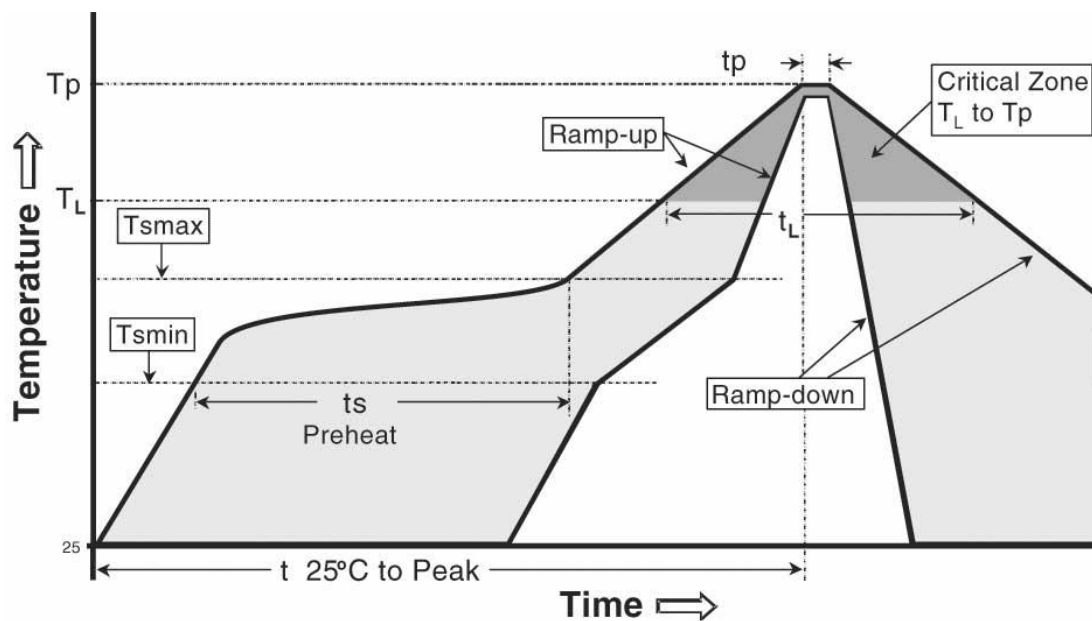


Figure 8 – Temperature profile.

4 PACKAGING

The DUO mXTEND™ (NN03-320) antenna booster is delivered in tape and reel packaging. Ambient room conditions according to Moisture Sensitivity Level (MSL1): Unlimited floor life at 30 °C/85%RH.

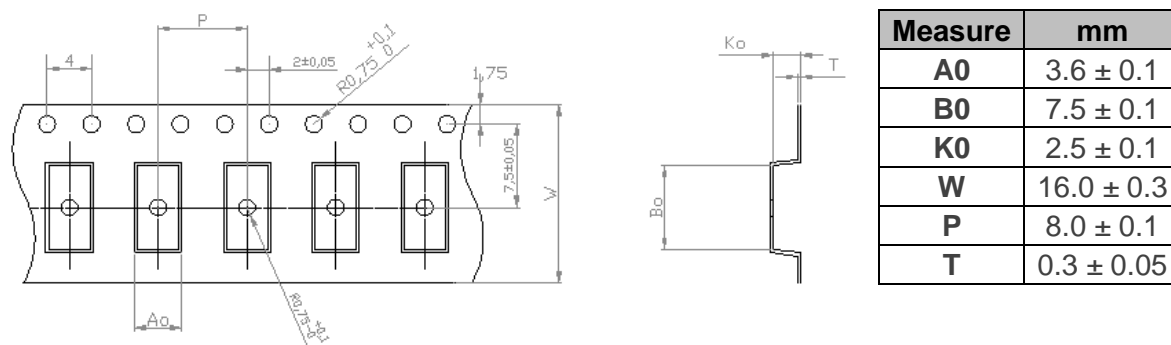


Figure 9 - Tape dimensions and tolerances.

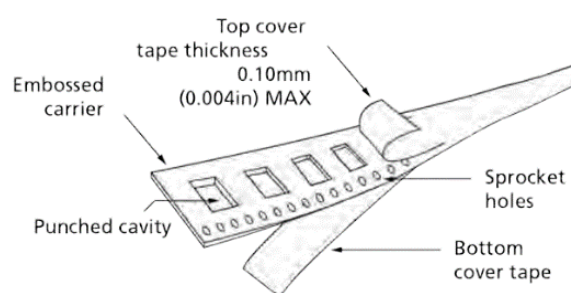
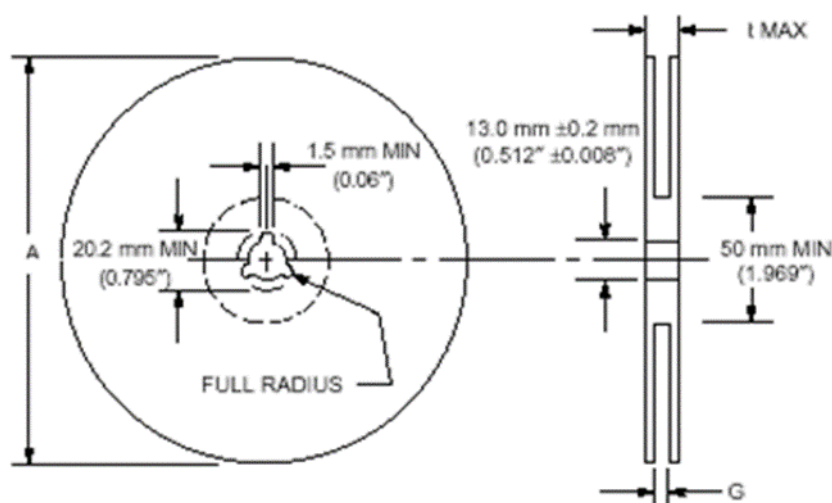


Figure 10 - Image of the tape.

REEL DIMENSIONS



Measure	mm
A	330 ± 1.0
G	16.4 ± 0.1
t max	20.4 ± 0.1

Reel Capacity: 2500 pcs

Figure 11 – 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 12 – Virtual Antenna® design journey for a successful IoT solution.

Step 1 - Feasibility: The Oxion™ platform 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 Oxion™ platform.

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.

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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 GNSS bands covered.

Bands	Frequency (MHz)	System
B1	1561.098 - 1591.7875	BeiDou
L1	1575.42	GPS
L1	1598.0625 - 1605.375	GLONASS
E1	1575.42 - 1602	Galileo

6.2 Bluetooth/Wi-Fi bands covered.

Comm. Standard	Frequency (MHz)	# band
Bluetooth/Wi-Fi	2400 – 2500, 4900 – 5875	dual band

6.3 5G bands covered.

Comm. Standard	Frequency (MHz)	# band
5G	3400 - 3800	single band

6.4 UWB bands covered.

Bands	Frequency (MHz)	System
Channel 5 and 9	6000 - 8500	Ultra Wide-Band

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