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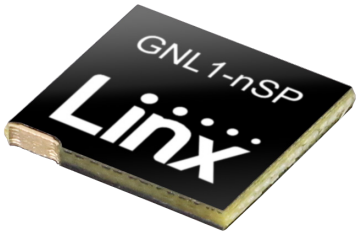
Datasheet

ANT-GNL1-nSP
Embedded L1 GNSS Antenna

The ANT-GNL1-nSP is a surface-mount embedded global navigation satellite system (GNSS) antenna supporting GPS, Galileo, GLONASS, Beidou and QZSS systems in the L1/E1/B1 bands.

The ANT-GNL1-nSP antenna exhibits excellent performance in a compact size (10 mm x 8 mm x 1 mm).

The ANT-GNL1-nSP is available in tape and reel packaging and is designed for reflow-solder mounting directly to a printed circuit board for high-volume applications.



Features

- Performance
  - VSWR: ≤ 1.4
  - Peak Gain: 4.4 dBi
  - Efficiency: 63%
- Compact package (9.6 mm x 8.4 mm x 0.9 mm)
- Linear polarization
- Omnidirectional radiation pattern
- Direct surface-mount PCB attachment
- Reflow- or hand-solder assembly

Applications

- Global navigation
  - GPS L1C, L1C/A
  - Galileo E1
  - GLONASS L1
  - Beidou B1C, B1I
  - QZSS L1
- Timing solutions

Ordering Information

Part Number	Description
ANT-GNL1-nSP	Surface-mount GNSS L1 antenna
AEK-GNL1-nSP	Surface-mount GNSS L1 antenna evaluation kit

Available from Linx Technologies and select distributors and representatives.

Table 2. Electrical Specifications

Frequency	GPS Bands	VSWR (max.)	Return Loss (dB)	Peak Gain (dBi)	Efficiency %
1561 MHz	Beidou B1I	1.4	-15.6	4.4	64
1575 MHz	GPS L1C, GPS L1C/A, Galileo E1, Beidou B1C, QZSS L1	1.4	-15.6	4.4	64
1601/1602 MHz	GLONASS L1	1.3	-18.7	3.6	63

Impedance	50 Ω	**Max Power**	5 W
Wavelength	1/4-wave	**Electrical Type**	Monopole
Polarization	Linear	**Radiation**	Omnidirectional

Electrical specifications and plots measured with a 40.0 mm x 70.0 mm (1.57 in x 2.76 in) reference ground plane.

Table 3. Mechanical Specifications

Parameter	Value
Connection	Surface-mount
Dimensions	9.6 mm x 8.4 mm x 0.9 mm (0.38 in x 0.33 in x 0.04 in)
Weight	0.1 g (0.004 oz)
Operating Temp. Range	-40 °C to +130 °C

Product Dimensions

Figure 1 provides dimensions for the ANT-GNL1-nSP antenna

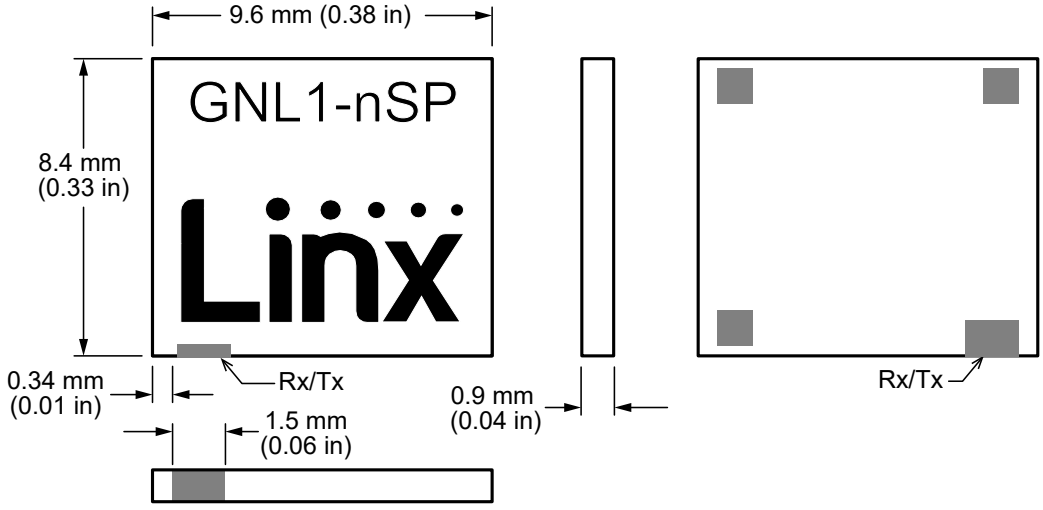


Figure 1. ANT-GNL1-nSP Antenna Dimensions

Product Signals

The signal definitions for the ANT-GNL1-nSP antenna are provided in Table 1

Table 1. ANT-GNL1-nSP Antenna Pin-Out Table

Function	Description
Rx/Tx	Solder pad
GND	Unmarked solder connections

VSWR

Figure 2 provides the voltage standing wave ratio (VSWR) across the antenna bandwidth. VSWR describes the power reflected from the antenna back to the radio. A lower VSWR value indicates better antenna performance at a given frequency. Reflected power is also shown on the right-side vertical axis as a gauge of the percentage of transmitter power reflected back from the antenna.

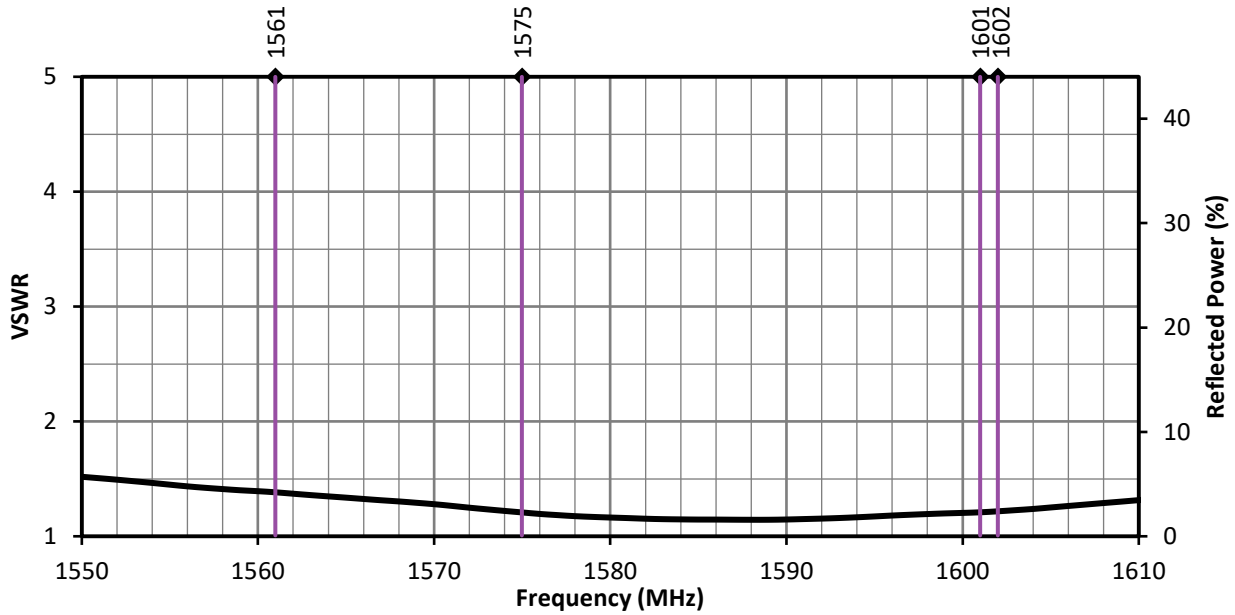


Figure 2. ANT-GNL1-nSP Antenna VSWR with Frequency Band Highlights

Return Loss

Return loss (Figure 3), represents the loss in power at the antenna due to reflected signals. Like VSWR, a lower return loss value indicates better antenna performance at a given frequency.

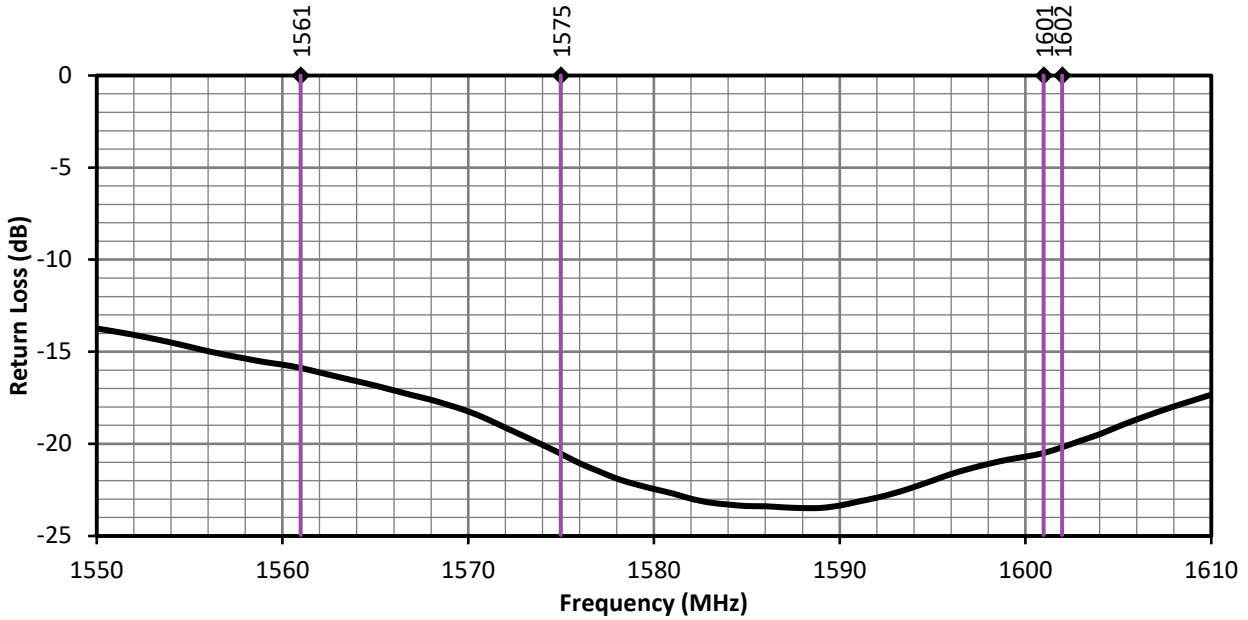


Figure 3. ANT-GNL1-nSP Return Loss with Frequency Band Highlights

Peak Gain

The peak gain across the antenna bandwidth is shown in Figure 4. Peak gain represents the maximum antenna input power concentration across 3-dimensional space, and therefore peak performance at a given frequency, but does not consider any directionality in the gain pattern.

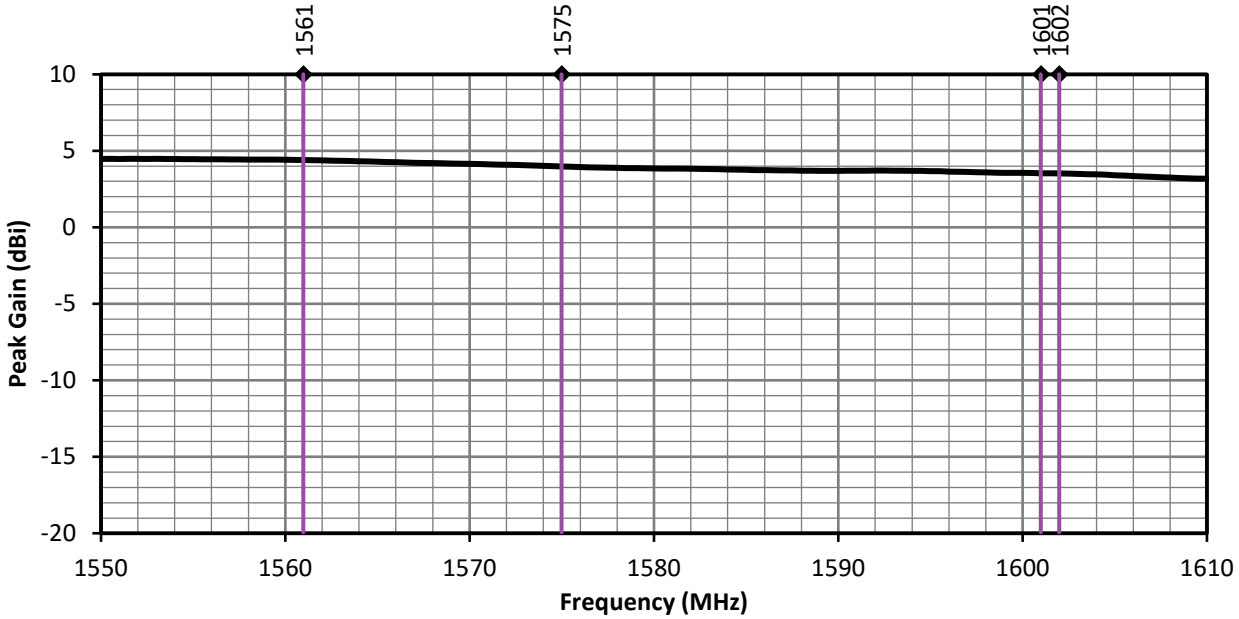


Figure 4. ANT-GNL1-nSP Antenna Peak Gain with Frequency Band Highlights

Radiation Efficiency

Radiation efficiency (Figure 5), shows the ratio of power delivered to the antenna relative to the power radiated at the antenna, expressed as a percentage, where a higher percentage indicates better performance at a given frequency.

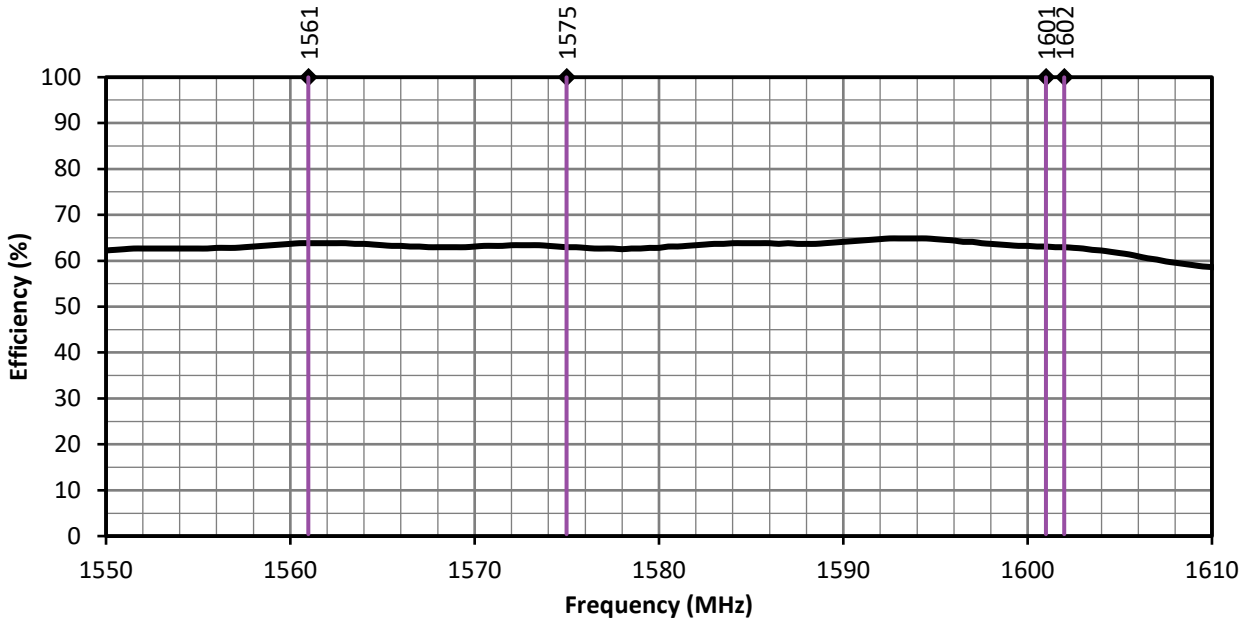
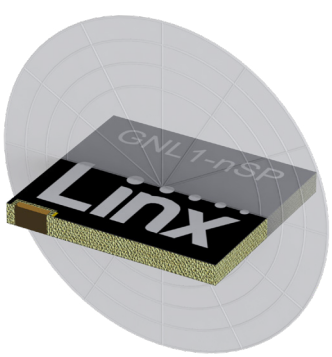


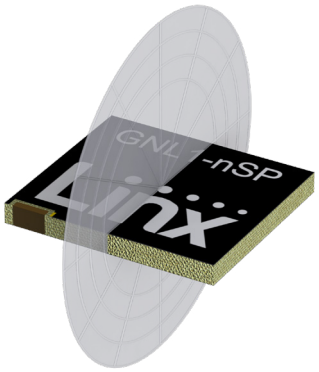
Figure 5. ANT-GNL1-nSP Radiation Efficiency with Frequency Band Highlights

Radiation Patterns

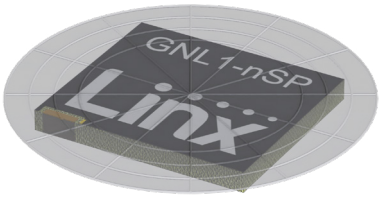
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns (Figure 6), are shown using polar plots covering 360 degrees. The antenna graphic above the plots provides reference to the plane of the column of plots below it. Note: when viewed with typical PDF viewing software, zooming into radiation patterns is possible to reveal fine detail.



XZ-Plane Gain

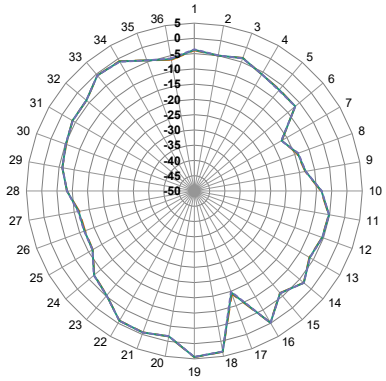


YZ-Plane Gain

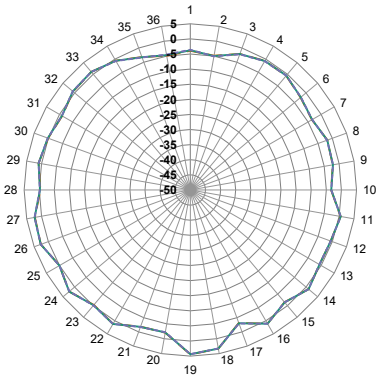


XY-Plane Gain

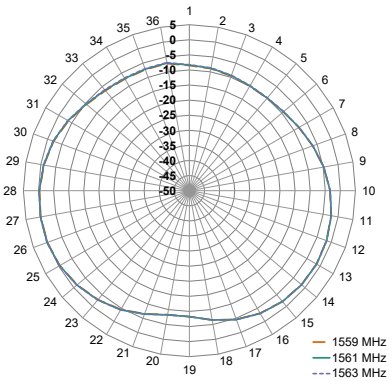
1559 MHz to 1563 MHz (1561 MHz)



XZ-Plane Gain

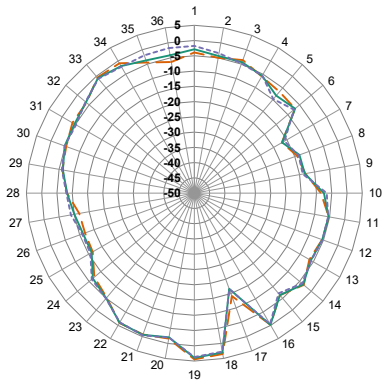


YZ-Plane Gain

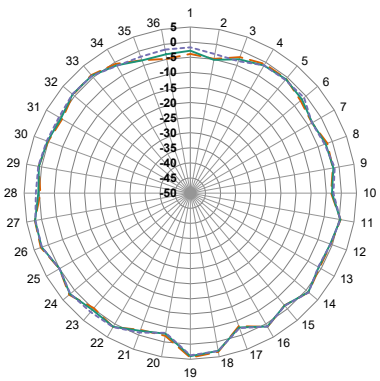


XY-Plane Gain

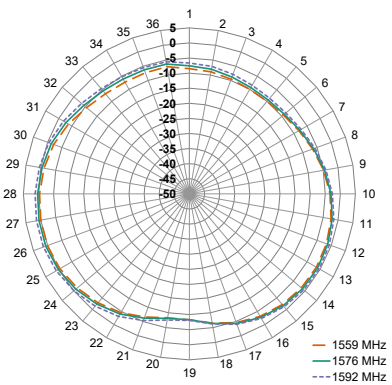
1559 MHz to 1592 MHz (1575 MHz)



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

Radiation Patterns

1598 MHz to 1606 MHz (1601 MHz)

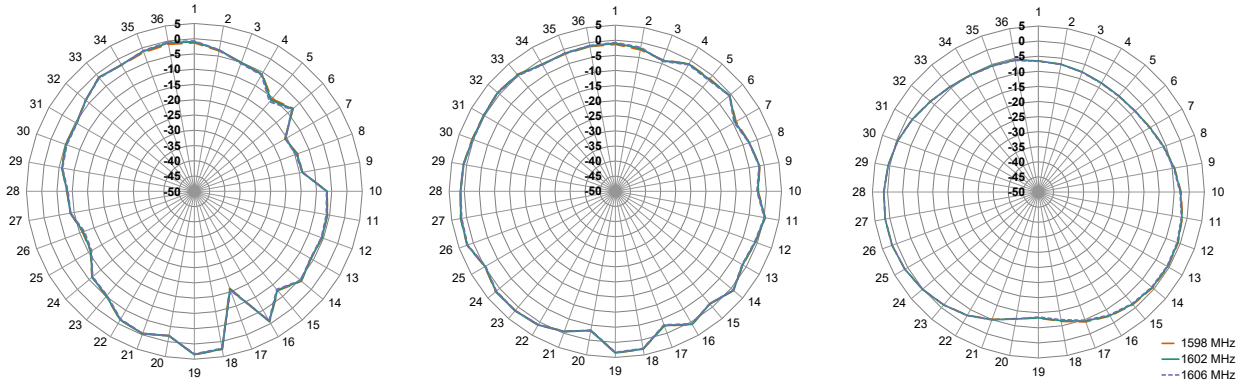


Figure 6. ANT-GNL1-nSP Antenna Radiation Patterns

Design Implementation

The recommended design implementation of the ANT-GNL1-nSP includes a matching network, ground plane and PCB transmission line from the antenna to the matching network and to the radio circuitry.

Ground Plane

The ANT-GNL1-nSP is a 1/4-wave monopole antenna, and requires a ground plane on the PCB to which it is mounted. Linx recommends a 40 mm x 70 mm or larger ground plane. The ANT-GNL1-nSP should be mounted in relation to the edge of the ground plane as shown in Figure 8. Other ground plane sizes and antenna mounting locations are possible.

Matching Network

Linx recommends inclusion of at least a 3-element, surface mount pi matching network of two parallel capacitors, (X1, X3) and one serial inductor, (X2) in all designs. (Figure 7) Surface mount components should be 0603 size. 0402 size components are also supported. The ANT-GNL1-nSP, as designed, does not require matching, but matching may improve end-product antenna performance depending on the effects of the enclosure, PCB and other electronic components. If no matching is necessary, the serial element may be populated with a zero-ohm resistor and no components in the two capacitor positions.

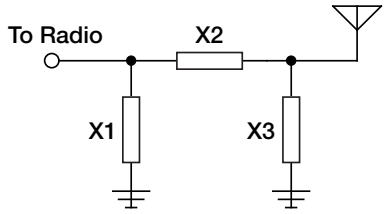


Figure 7. Matching Network Recommendation

Recommended PCB Layout

Figure 8 shows the recommended printed circuit board layout for the ANT-GNL1-nSP antenna.

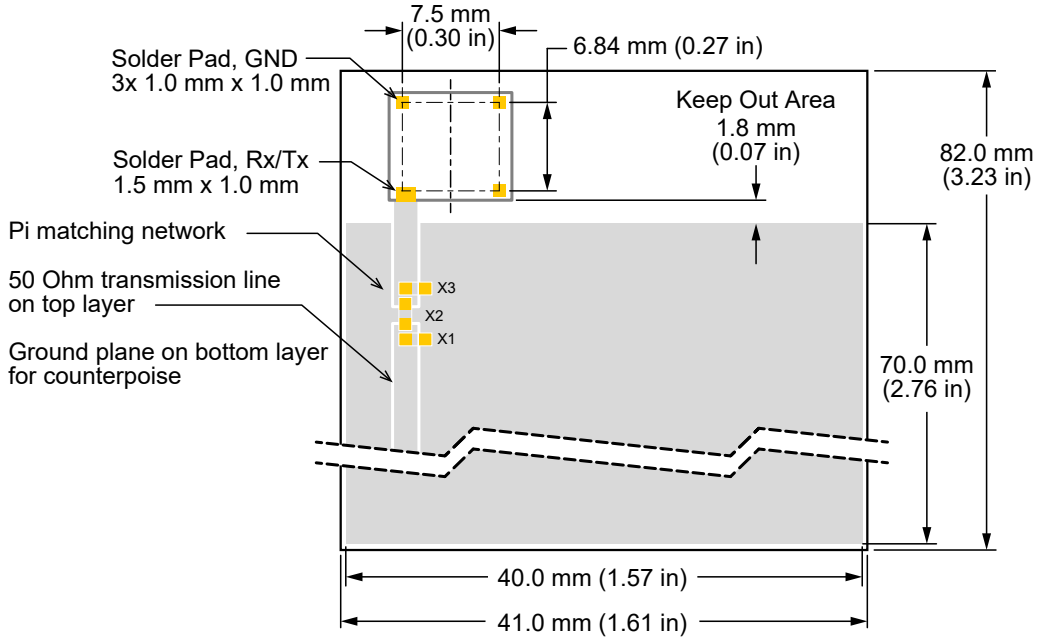


Figure 8. ANT-GNL1-nSP Recommended PCB Layout

Transmission Lines for Embedded Antennas

For most designs, Linx recommends a microstrip transmission line for the ANT-GNL1-nSP. A microstrip transmission line is a PCB trace that runs over a ground plane to maintain the characteristic impedance for optimal signal transfer between the antenna and radio circuitry. Linx designs all antennas with a characteristic impedance of 50 Ω.

Important practices to observe when designing a transmission line are:

- Keep all transmission lines to a minimum length for best signal performance.
- Use RF components that also operate at a 50 Ω impedance.
- If the radio is not on the same PCB as the antenna the microstrip should be terminated in a connector enabling a shielded cable to complete the antenna connection to the radio, as exemplified on the ANT-GNL1-nSP evaluation board.
- For designs subject to significant electromagnetic interference, a coplanar waveguide transmission line may be used on the PCB.

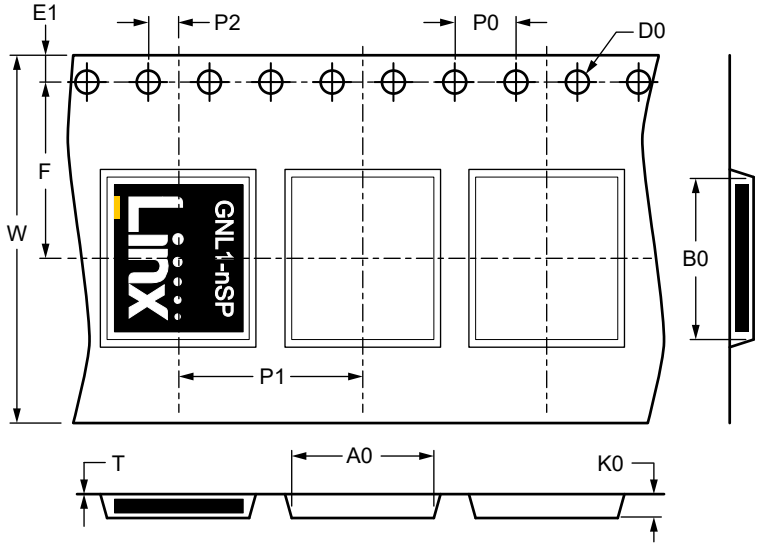
The design of a PCB transmission line can be aided by many commercially available software packages which can calculate the correct transmission line width and gap dimensions based upon the PCB thickness and dielectric constant used.

Reflow Solder Profile

The ANT-GNL1-nSP uses a typical RoHS solder reflow profile. Refer to application note AN-00504 on the Linx website for more information.

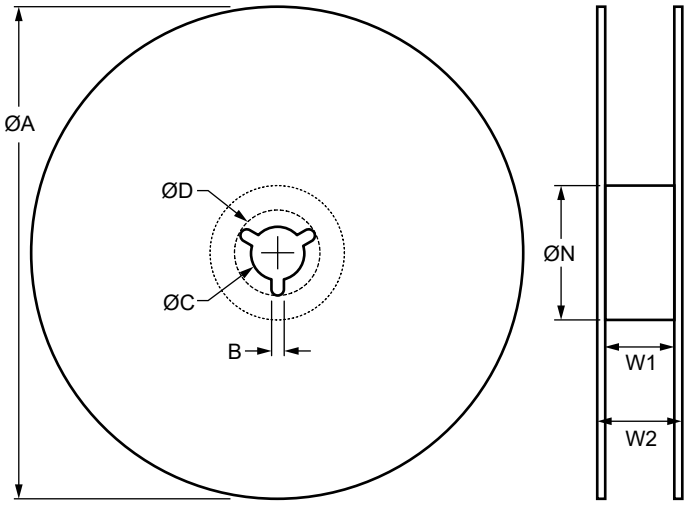
Tape and Reel Packaging

Tape and reel packing specifications per EIA-481-F. Figure 9 shows the dimensions of the tape in which the ANT-GNL1-nSP is packaged. Reel dimensions are provided in Figure 10.



Tape Dimensions	
Symbol	Dimension (mm)
W	24.00
P1	12.0
E1	1.75
F	11.5
D0	1.50
D1	-
P0	4.00
P2	2.00
A0	8.7
B0	9.9
K0	1.6
T	0.51

Figure 9. Tape Specifications for the ANT-GNL1-nSP Antenna



Reel Dimensions		
Symbol	Qty	Unit
QTY per reel	3000	pcs
Tape width	24.0	mm
A	Ø609.0 max.	mm
B	1.5	mm
C	Ø13.0	mm
D	20.2	mm
N	Ø50.0	mm
W1	24.4	mm
W2	37.0 max.	mm

Figure 10. Reel Specifications for the ANT-GNL1-nSP Series Antenna

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