Per 15.203, the antenna is internal and permanently attached. It is not intended to be serviced by the customer and is, therefore only serviceable by Logitech, Inc. authorized personnel.

The antenna is a Rufa 2.4GHz SMD Antenna by gigaAnt , with 2.67dBi max peak gain once installed on the PCBA.

The gigaAnt product specification sheet is included in this exhibit.

Product Specification

Rufa 2.4 GHz SMD Antenna

Product Specification

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1. FEATURES

- Designed for 2.4 GHz applications [Bluetooth™, WiFi™ (802.11b/g), Zigbee™, WiMedia™ etc.]
- Intended for SMD mounting
- Supplied in tape on reel

2. DESCRIPTION

The Rufa antenna is intended for use with all 2.4 GHz applications. The antenna requires a groundplane, i.e your device acts as an active part of the antenna and thus demand careful consideration concerning its placement

3. APPLICATION

- Mobile phones
- PDAs
- Headsets
- Laptops
- PC- Cards
- CF- Cards

4. MODEL NAMES

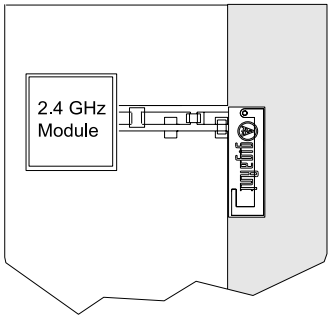
30 30 A5839 - 01

Drawing No.

Technology
-PCB

Antenna Family
-SMD

Left feeding



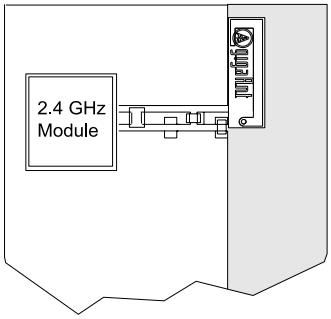
30 30 A5887 - 01

Drawing No.

Technology
-PCB

Antenna Family
-SMD

Right feeding



5. GENERAL DATA

Product Name	Rufa 2.4 GHz
Article No.	3030A5839-01(Left)
	3030A5887-01 (Right)
Frequency	2.4-2.5 GHz
Polarization	Linear
Operating temperature	-40 to + 85 degC
Impedance	50 Ohm
Weight	0.1 gram
Antenna type	SMD

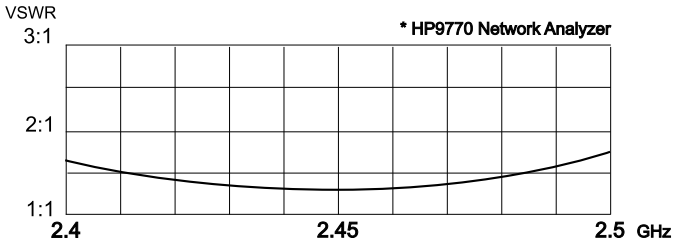
6. ELECTRICAL CHARACTERISTICS

	Characteristics			Conditions*
	Min	Typ	Max	
Peak Gain	4.0 dBi	4.1 dBi	4.4 dBi	Frequency 2.4-2.5 GHz, Measured in 3D chamber (near field)
Efficiency	66%	68%	69%	
VSWR	1.3:1	1.5:1	1.6:1	Frequency 2.4-2.5 GHz, Measured in Network Analyzer

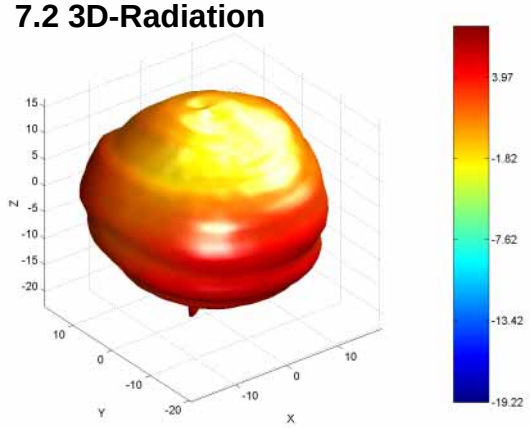
*Note all data provided in this table are based on the gigaAnt reference board

7. ELECTRICAL PERFORMANCE

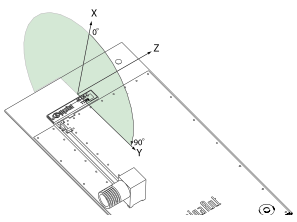
7.1 Voltage Standing Wave Ratio



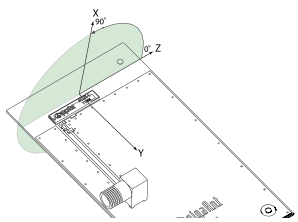
7.2 3D-Radiation



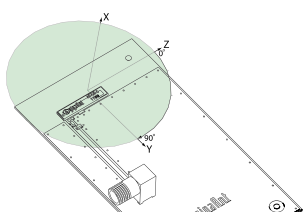
7.3 Radiation patterns



XY- Plane

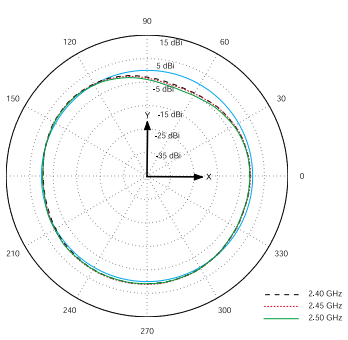


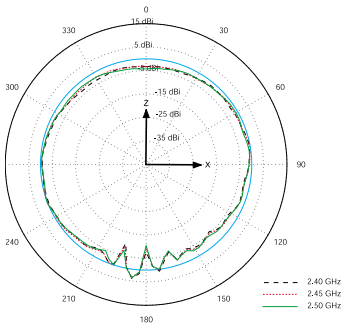
XZ- Plane

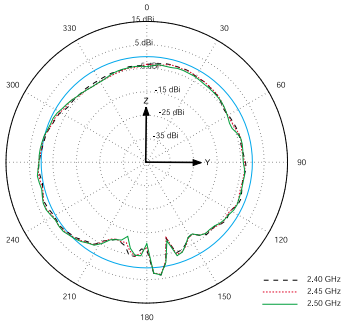


YZ- Plane

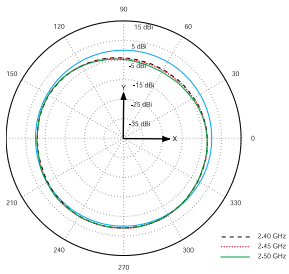
Total polarization

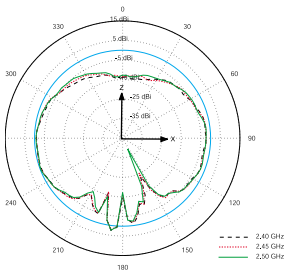


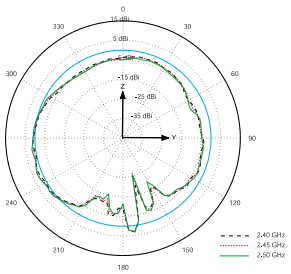




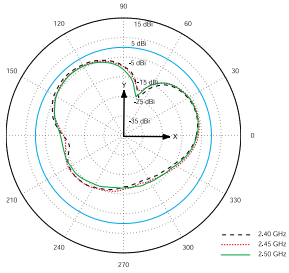
Vertical polarization

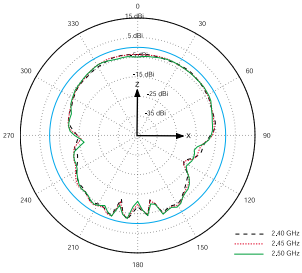


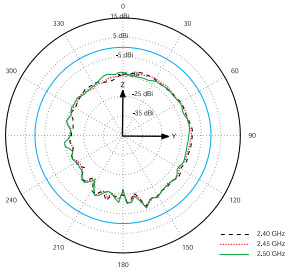




Horizontal polarization

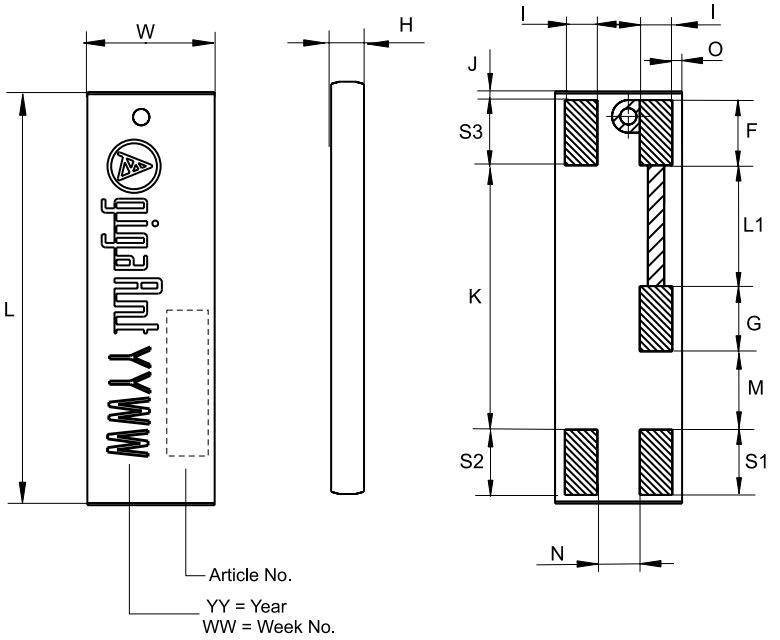




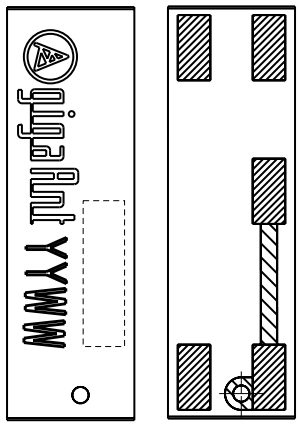


8. ANTENNA DIMENSIONS

Art no: 3030A5839-01 (Left)



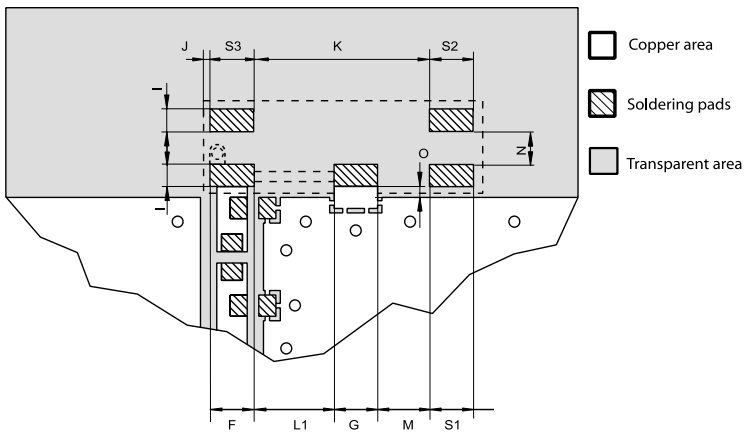
Art no: 3030A5887-01 (Right)



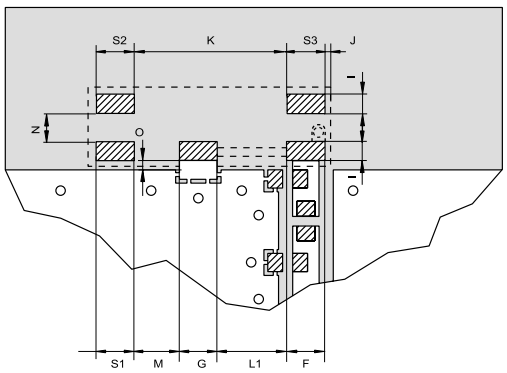
L	W	H	G	F	S1	S2	S3	I	J	K	L1	M	N	O
Length	Width	Height	Ground	Feed	Solder									
12.8 ±0.2	3.9 ±0.2	1.1±0.15	2.0±0.1	2.0±0.1	2.0±0.1			1.0±0.1	0.25±0.1	8.1±0.1	3.7±0.1	2.4±0.1	1.3±0.1	0.3±0.15
Dimensions in millimeter														

9. ANTENNA FOOT PRINT

Art no: 3030A5839-01 (Left)



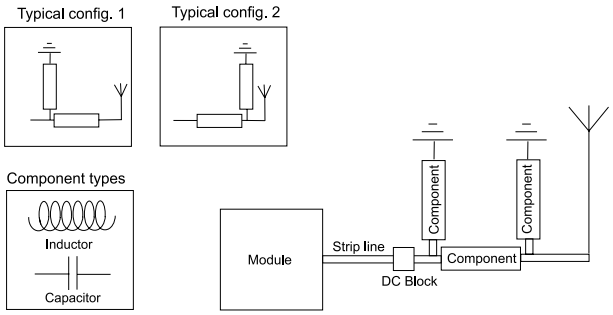
Art no: 3030A5887-01 (Right)



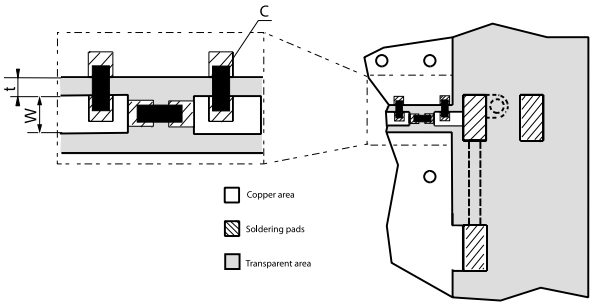
G	F	S1	S2	S3	I	J	K	L1	M	N	O
Ground	Feed	Solder									
2.0±0.1	2.0±0.1	2.0±0.1			1.0±0.1	0.25±0.1	8.1±0.1	3.7±0.1	2.4±0.1	1.3±0.1	0.5±0.15
Dimensions in milimeters											

10. ELECTRICAL INTERFACE

10.1 Transmission line and matching



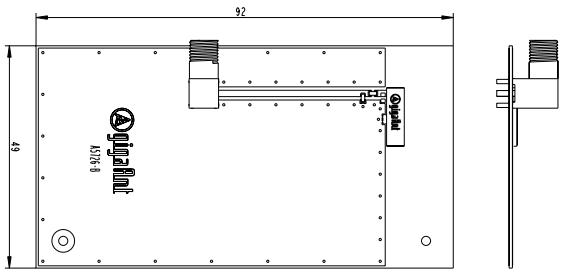
The matching network has to be individually designed using one, two or three components.



t, w = Unique dimensioning according to your PCB *
C = Inductor and capacitor values according to your specific device*

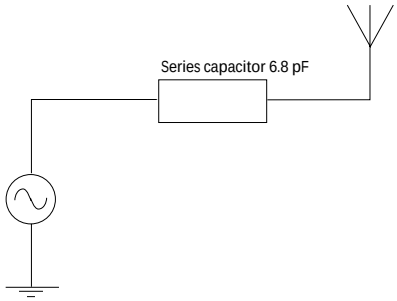
* gigaAnt provides this service upon request

10.2 Test board dimensions



The testboard is designed for evaluation purposes for Rufa 2.4 GHz SMD antenna. The card has the same size as a typical PCMCIA card and is fitted with an SMA connector.

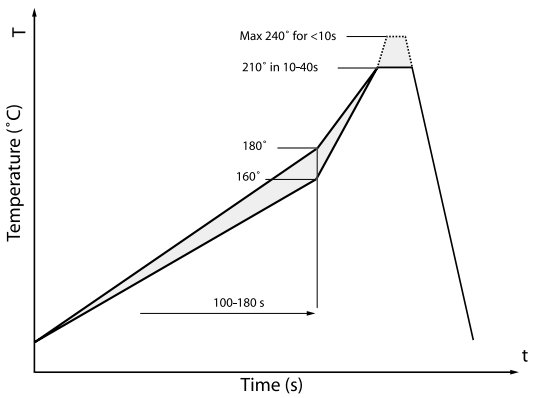
10.3 Test board matching



The testboard is matched with above specified component. Note! The component value(s) will vary depending on size of PCB, surrounding components etc.

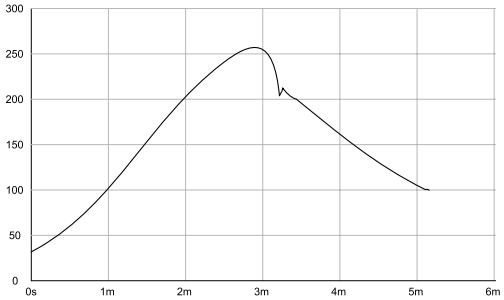
11. SOLDERING

11.1 Recommended soldering conditions



11.2 Leadfree soldering

The antenna has been tested and approved for leadfree soldering. The reflow curve and solder paste used is listed below.



Solder paste: KOKI S3X58-M405

12. RELIABILITY

12.1 Temperature and Humidity

Item	Standard	Low	High	Duration
Operating temperature	EN/IEC 60068-2-2, Test Bd: Dry heat	-30 degC	+90 degC	-
Temperature cycling	EN/IEC 60068-2-14, Test Na: Change of temperature	-40 degC	+90 degC	500 cycles / 10 min
Storage life Humidity	EN/IEC 60068-2-1, Test Ca: Damp heat	+60 degC / 90% RH		500 h
Storage life Low temperature	EN/IEC 60068-2-1, Test Ad: Cold	-55 degC	-	500 h
Storage life High temperature	EN/IEC 60068-2-2, Test Bb: Dry heat	-	+125 degC	500 h

12.2 Mechanical

Item	Standard	Low	High	Duration
Bending	IEC 60068-2-21, Test Ue1: Bending	Bending 1 mm at a rate of 1 mm/s with support at end of PCB 1mm depth on reference board		
Shear	IEC 60068-2-21, Test Ue3: Shear	Force of 5 N applied to the side of the antenna.		
Drop test		Dummy weight: 150g Height: 170cm		One drop at each side, total drops: 6
Vibration	EN/IEC 60068-2-6, Test Fc (sinusoidal)	Acceleration spectral density:10-1000Hz Acceleration: 20m/s2 Number of axes: 3 mutually perpendicular		5 cycles per axis

12.3 Miscellaneous

Item	Standard	Low	High	Duration
Solderability	EN/IEC 60068-2-58, Test Td	Visual inspection of soldering pads. Estimation of how many % of the pads that are well tin plated.		

12.4 Judgement standard

The judgement of the above tests should be made as follows:
1. Visual inspection - Normal apperance with no obvious cracking, peeling-off.
2. Electrical inspection - The DUT satisfies the VSWR specification throughout the 2.4-2.5 GHz band

13. HAZARDOUS MATERIAL REGURATION CONFORMANCE

Cadmium and cadmium compound.	Lead and lead compound
Organic brominated compound (PBB, PBDE)	Mercury and mercury compound
Polychlorinated biphenyl (PCB)	Sexivalent chrome compound
Polychlorinated naphthalene (PCN)	Chlorinated paraffin (CP)
Organic tin compound	Mirex
Asbestos	Formaldehyde
Azo compound	Tetra-bromo-bisphenol-A-bis (TBBP-A-bis)

14. APPLICATION EXAMPLE

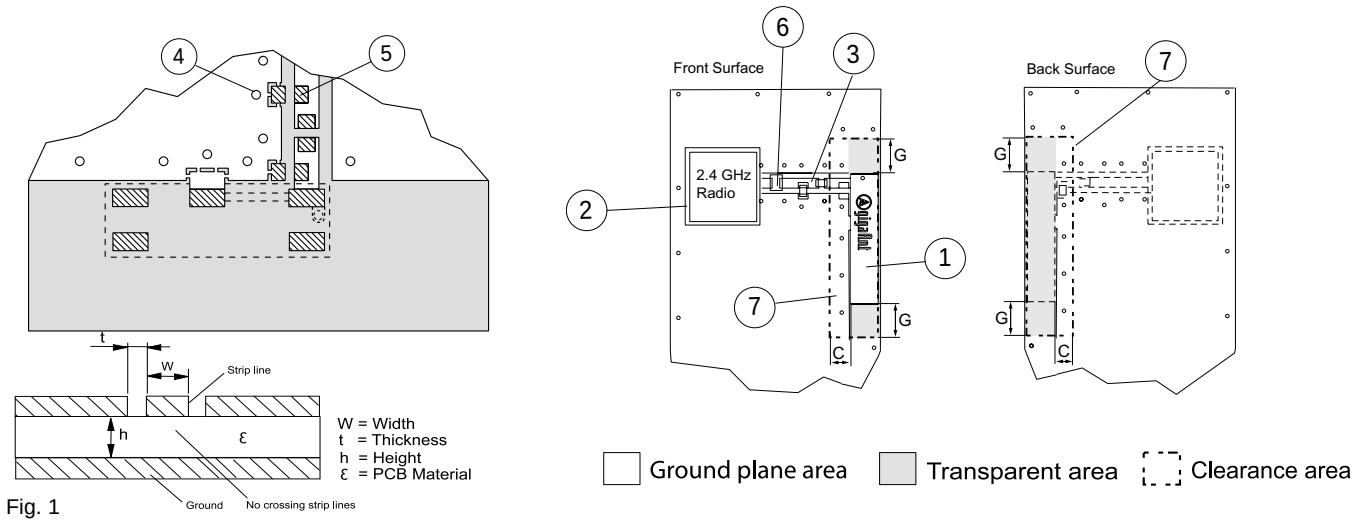


Fig. 1

General

The antenna is of a quarter wave type and is dependent on the groundplane area to complete the antenna function. The antenna performance is also dependent on the size of the groundplane and the tranparent area.

1. **Placement of the antenna**
   The antenna shall be placed on a transparent area without underlying groundplane at the edge of the PCB oriented as above. Groundplane area surrounding the antenna should be with a clearence of G=3-5 mm.
2. **Placement of 2.4 GHz module**
   To avoid losses in the strip line, the module shall be placed as close to the antenna as possible.
3. **Strip line**
   The strip line must be dimensioned according to your specific PCB. (see fig 1). No crossing strip lines are allowed between the strip line and its ground plane.
4. **Via Connections**
   To avoid spurious effects via connections must be made to analogue ground.
5. **Component matching**
   Component values are depending on antenna placement, PCB dimensions and location of other components.
6. **DC Block**
   Might be needed depending on RF Module configuration.
7. **Clearance**
   No components allowed within the clearence area with a minimum distance to other components, C= 3-5 mm.
8. **Casing material**
   No metal casing or plastics using metal flakes should be used, avoid also metallic based paint or laquer. Keep a minimum clearance of 1mm between the antenna and the casing.

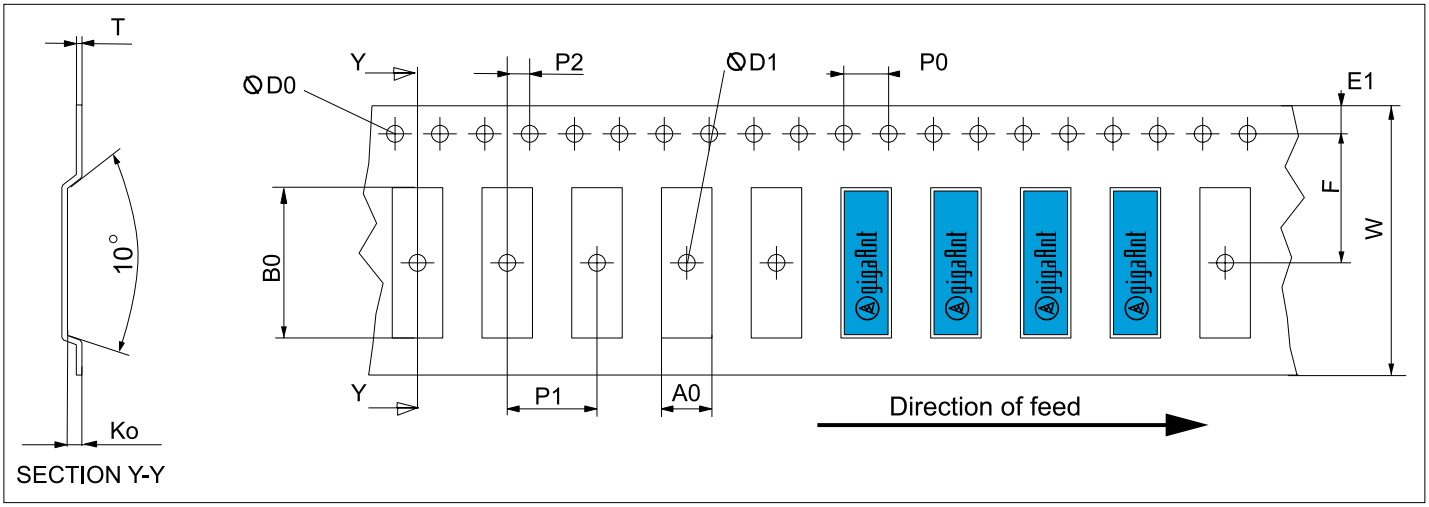
Note ! Incorrect implementation of the antenna will affect the performance. Contact gigaAnt for implementation services.

15. PACKAGING

15.1 Shelf storage recommendation

Temperature	-10 to +40 degree C
Humidity	Less than 75% RH
Shelf Life	18 Months
Storage place	Away from corrosive gas and direct sunlight

15.2 Tape characteristics

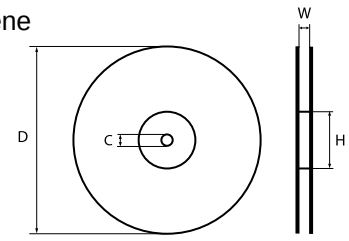


W	F	E_1	P_0	P_1	P_2	A_0	B_0	K_0	T	D_0	D_1
24±0.3	11.5 ±0.1	1.75±0.1	4.0±0.1	8.0±0.1	2.0±0.1	4.5±0.1	13.4±0.1	1.5±0.1	0.3±0.05	1.5±0.1	1.5±0.1
Dimensions in millimeter											

Quantity	Leading space	Trailing space
1000 Pcs / reel	50 blank antenna holders	37 blank antenna holders

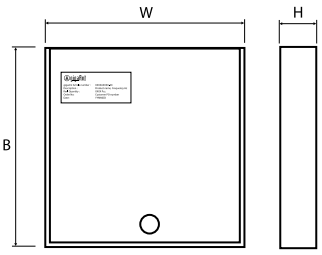
15.3 Reel dimension

Material: Conductive Polystyrene
Width [mm] W: 24
Reel dia [mm] D: 180(7")
Hub dia [mm] H: 50(2")
Shaft dia [mm] C: 13



15.4 Box dimension

Material: Cardboard
Width [mm] W: 195
Breadth [mm] B: 195
Thickness [mm] H: 37



15.5 Bag properties

Antistatic Aluminium Moisture Barrier Bag
Thickness [mil] T: 3.2

15.6 Reel label information

gigaAnt
gigaAnt Article number : XXXXAXXXX-XX
Description : Product name, Frequenzy Hz
Reel Quantity : XXXX Pcs.
Order No: Customer PO number
Date: YYMMDD

16. CONTACT INFORMATION

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Or your local gigaAnt representative