

# LPWA/ Sub-GHz Cellular Ceramic Chip Antenna



ACAR3705-SB



37.0 x 5.0 x 5.0 mm  
RoHS/RoHS II Compliant  
MSL = N/A

## Features

- NB-IoT, LTE Cat M1 coverage from 698 - 960 MHz
- LoRa/Sigfox at 868, 915 MHz
- Linear polarization
- SMD antenna

## Applications

- IoT
- M2M
- LPWA, NB-IoT, LoRa, SigFox applications
- Sub GHz Cellular band applications
- Smart meter
- Medical
- Smart city

## Electrical Specifications

Parameters	Min.	Typ.	Max.	Units	Note
Frequency Range		698 ~ 960		MHz	
VSWR			4.5		Depends on the environmental conditions
Polarization	Linear				
Impedance		50		$\Omega$	
Gain	Average		-1.41	dBi	
	Peak		0.61	dBi	
Efficiency		40		%	@ 698 MHz
		60			@ 791 MHz
		60			@ 824 MHz
		50			@ 862 MHz
		50			@ 880 MHz
		40			@ 960 MHz

\* Evaluation board size: 45 x 120 mm

\* Actual Electrical Value will depend on the size of ground plane in use

## Environmental Characteristics

Parameters	Description
Termination	Ag (Pb free)
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
Relative Humidity	0 ~ 95 %

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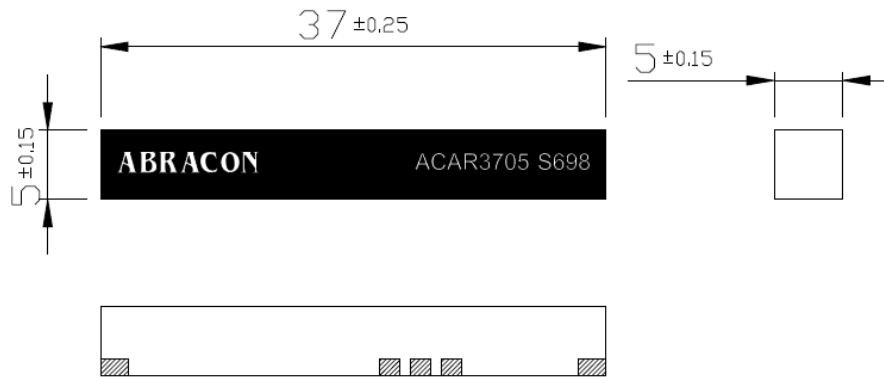


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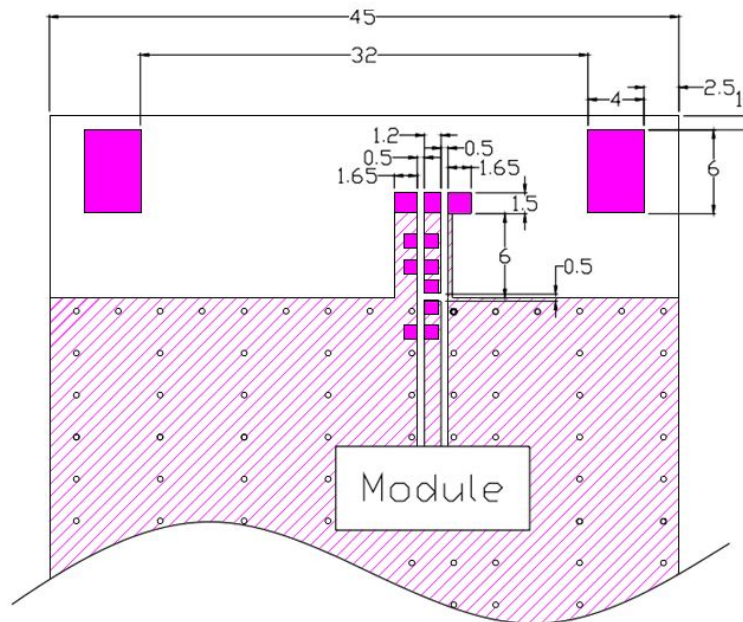


37.0 x 5.0 x 5.0 mm  
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## Product Dimensions (Unit: mm)



## Customer's Requirement Layout Dimension (Unit: mm)



Matching Circuit

# LPWA/ Sub-GHz Cellular Ceramic Chip Antenna



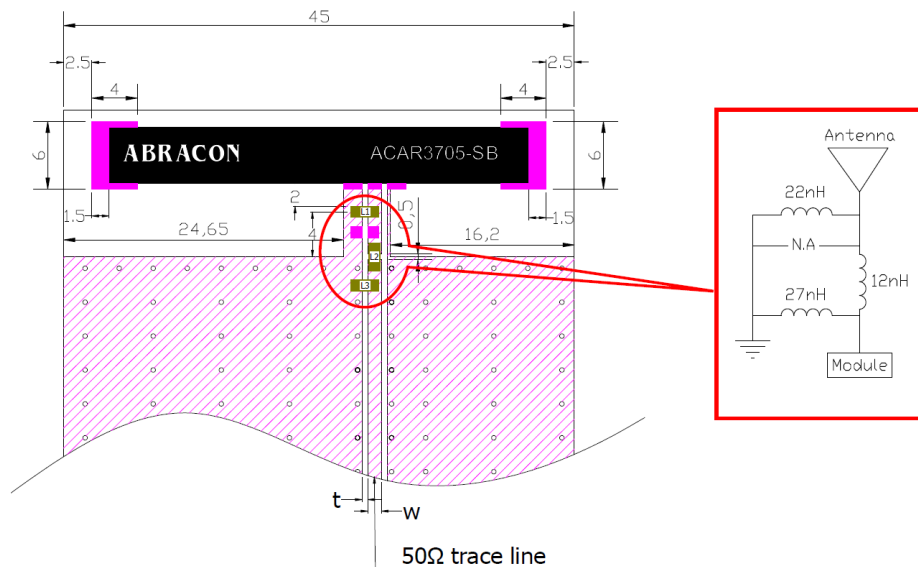
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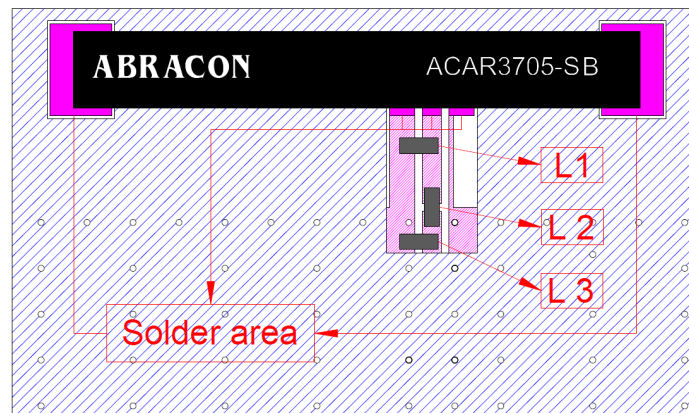
37.0 x 5.0 x 5.0 mm  
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## Product Dimensions

Recommended foot print for Evaluation Board (Unit: mm)



t, w = Dimensions according to the PCB in use



Circuit Symbol	Size	Description
L1	0402	22 nH Inductor
L2	0402	12 nH Inductor
L3	0402	27 nH Inductor

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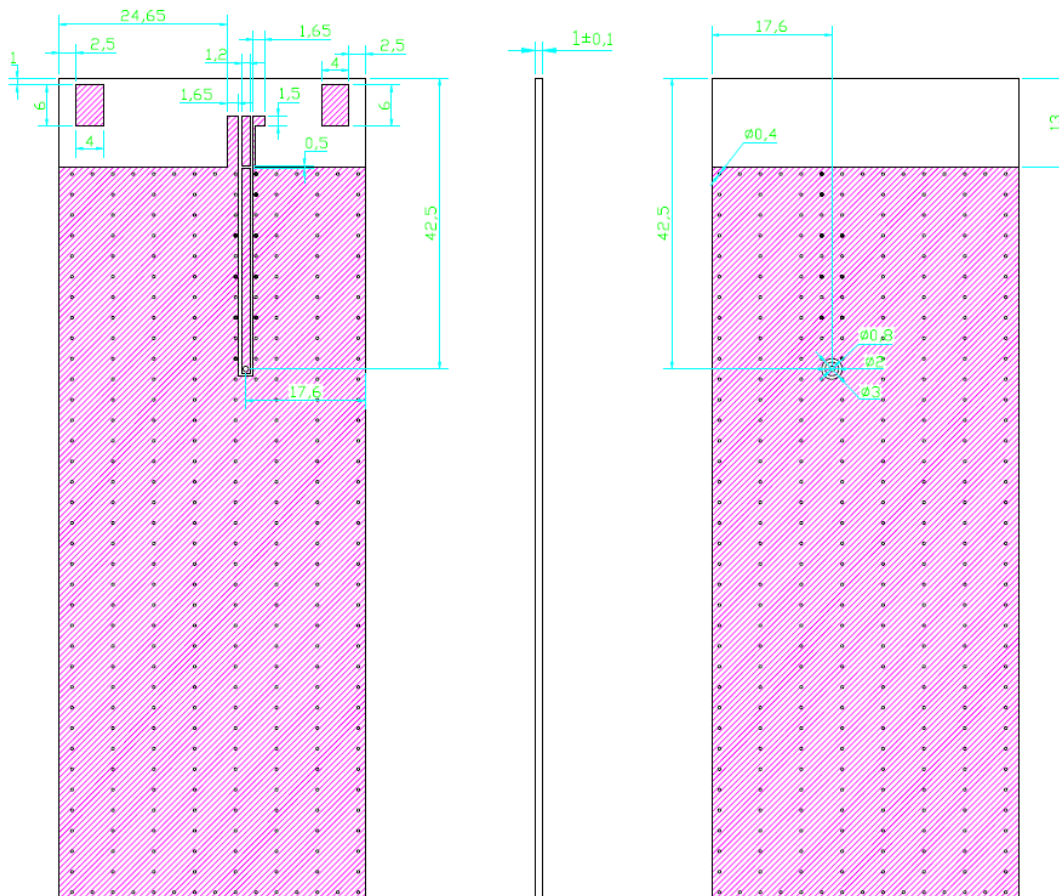
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## Product Dimensions

### Test Board Dimensions (Unit: mm)



# LPWA/ Sub-GHz Cellular Ceramic Chip Antenna

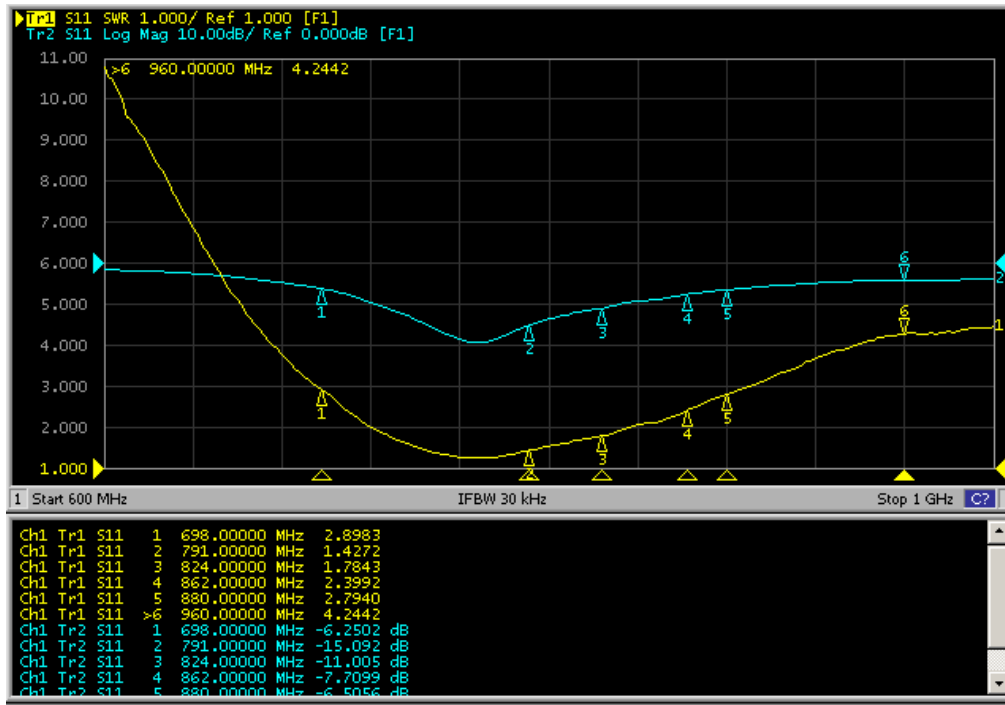


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## Return Loss and VSWR



Frequency (MHz)	698	791	824	862	880	960
Return Loss (dB)	-6.25	-15.02	-11	-7.7	-6.5	-4.17
VSWR	2.89	1.42	1.78	2.39	2.79	4.24

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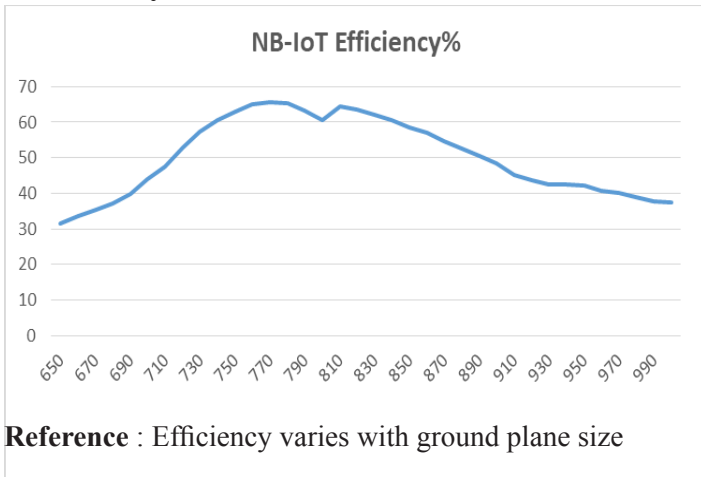


37.0 x 5.0 x 5.0 mm  
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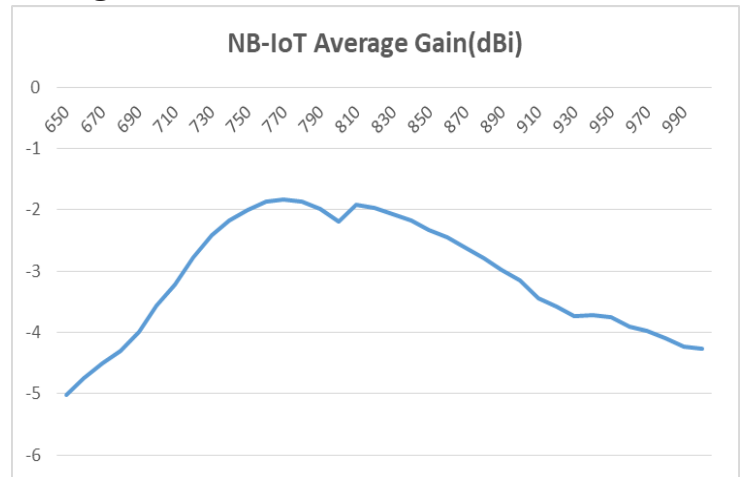
## Gain and Efficiency

Ground Length = 107 mm

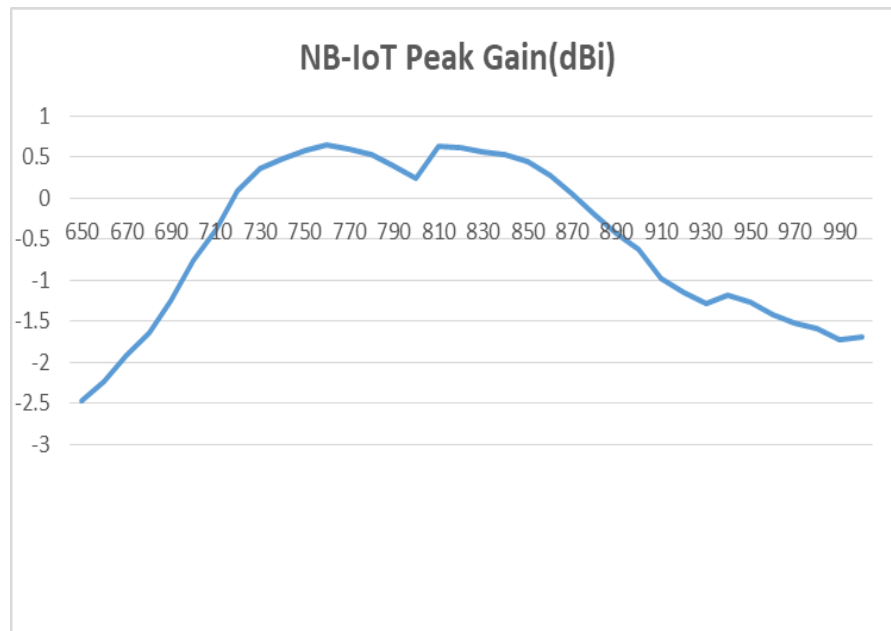
### Efficiency



### Average Gain



### Peak Gain



Frequency (MHz)	698	791	824	862	880	960
Efficiency (%)	43.95	63.31	63.57	56.95	52.49	40.62
Average Gain (dBi)	-3.57	-1.98	-1.96	-2.44	-2.79	-1.41
Peak Gain (dBi)	-0.76	0.39	0.61	0.27	-0.19	-1.41

# LPWA/ Sub-GHz Cellular Ceramic Chip Antenna

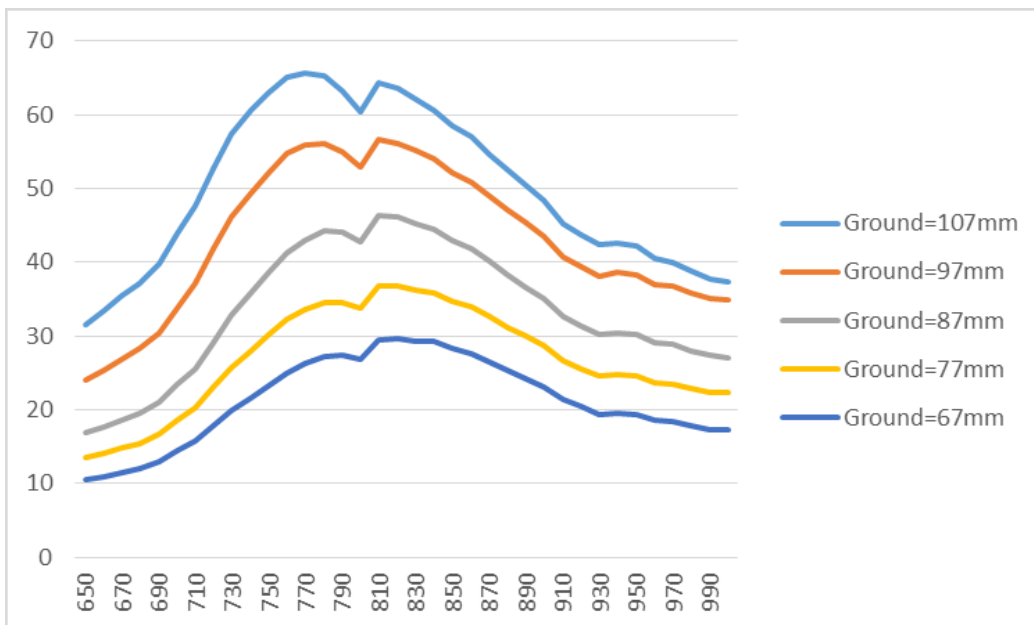
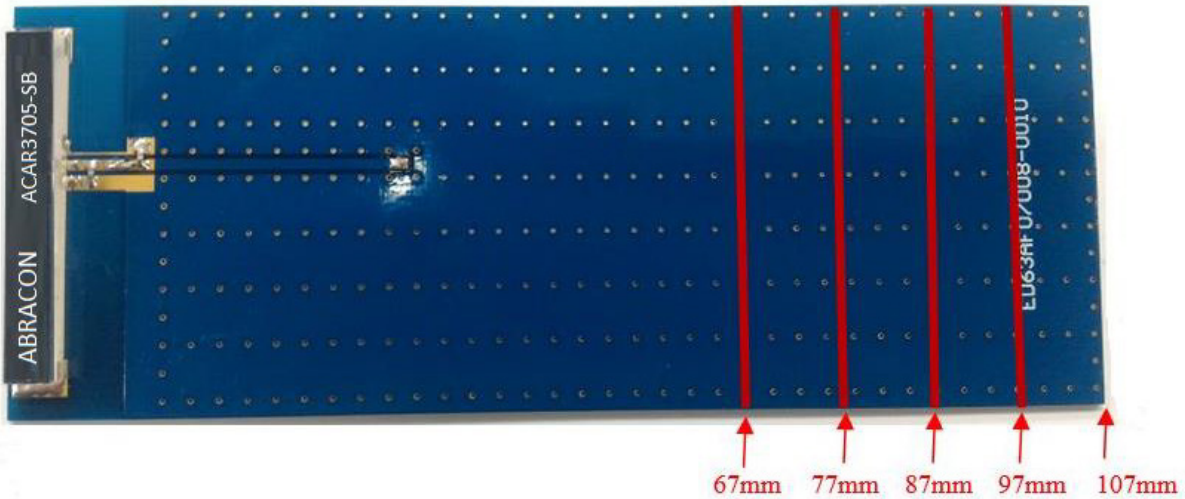


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## Gain and Efficiency



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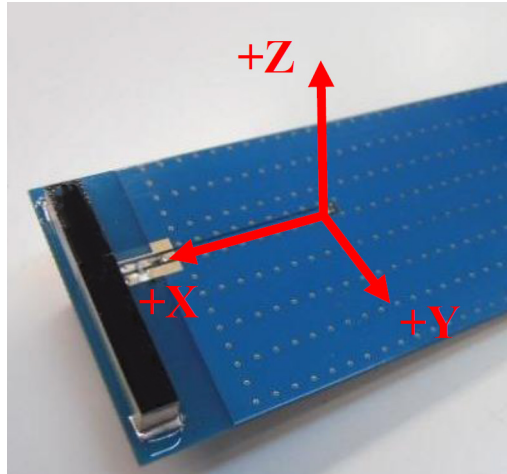


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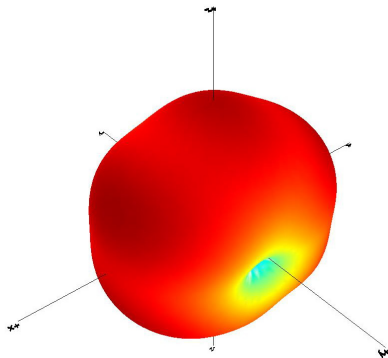


37.0 x 5.0 x 5.0 mm  
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MSL = N/A

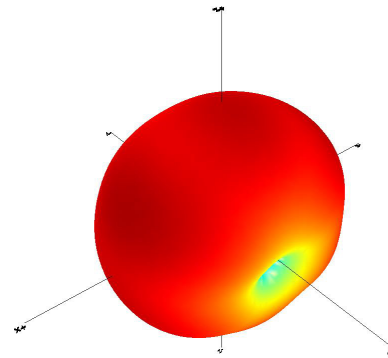
## Radiation Patterns



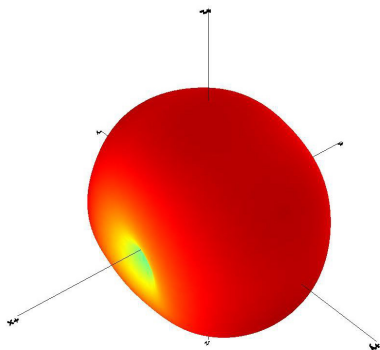
700 MHz



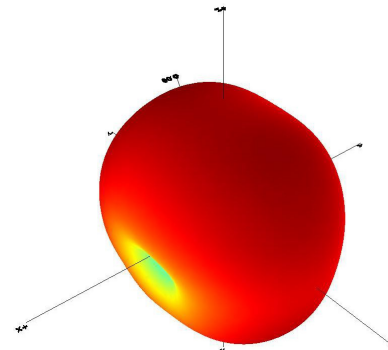
760 MHz



824 MHz



960 MHz





# LPWA/ Sub-GHz Cellular Ceramic Chip Antenna

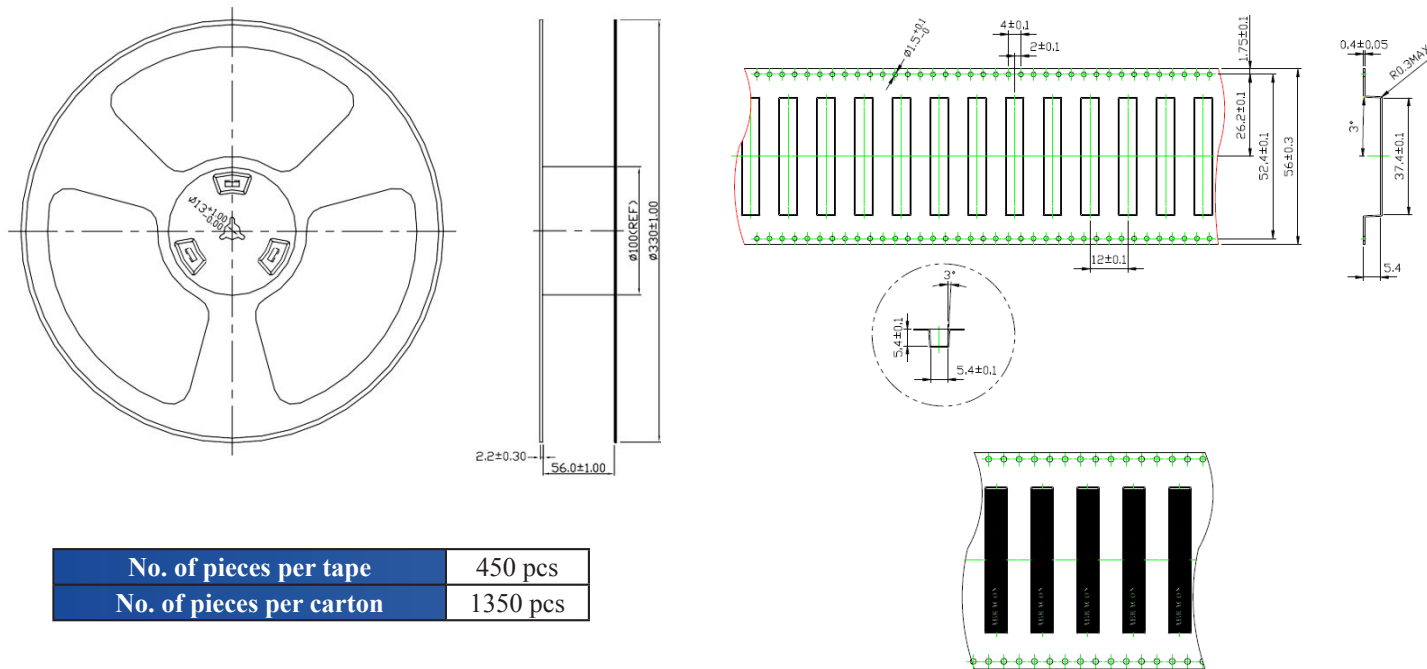


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37.0 x 5.0 x 5.0 mm  
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MSL = N/A

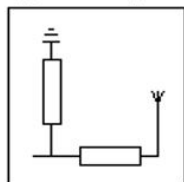
## Packaging (Unit: mm)



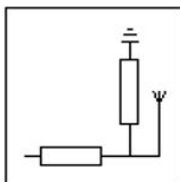
No. of pieces per tape	450 pcs
No. of pieces per carton	1350 pcs

## Transmission Line and Matching

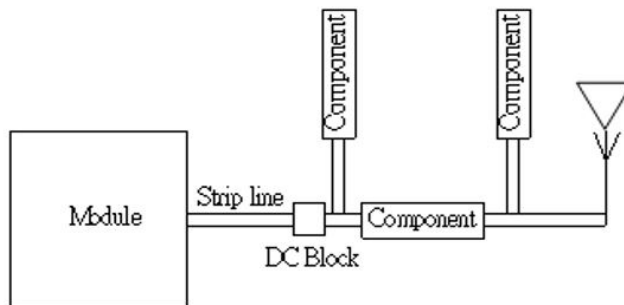
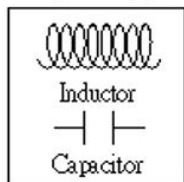
Typical config.1



Typical config.2



Component types



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

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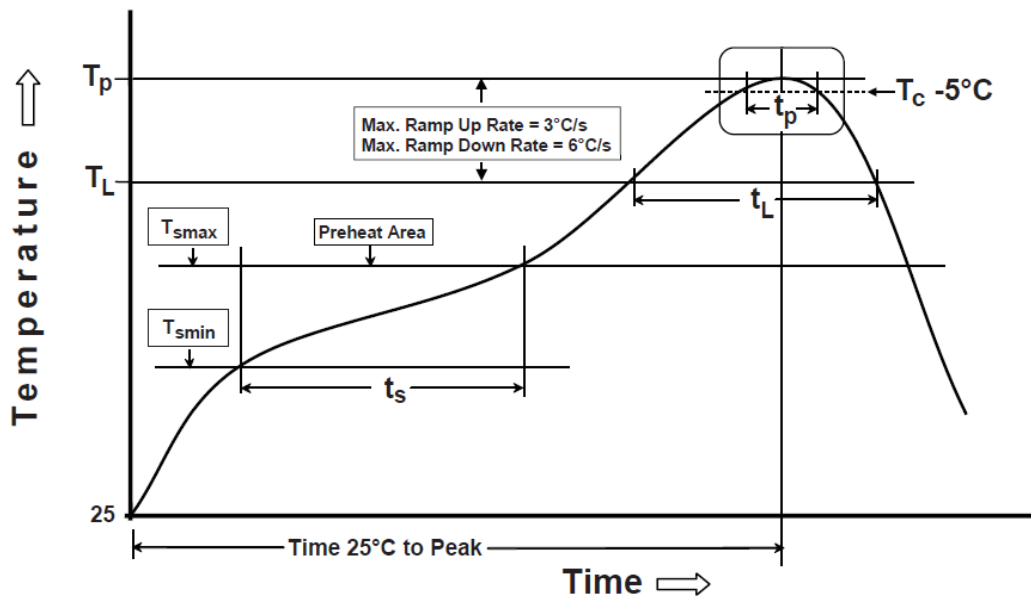


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## Recommended Reflow Soldering Profile

Phase	Profile Features	Pb- Free Assembly (SnAgCu)
Preheat	- Temperature min (T <sub>smin</sub> )	150°C
	- Temperature max (T <sub>smax</sub> )	200°C
	- Time (ts) from T <sub>smin</sub> to T <sub>smax</sub>	60 – 120 sec
Ramp-up	Avg. Ramp-up Rate (T <sub>smax</sub> to TP)	3°C/second (max)
Reflow	-Temperature (TL)	217°C
	-Total time above TL (t <sub>L</sub> )	30-100 sec
Peak	-Temperature (TP)	260°C
	-Time (tp)	20-30 sec
Ramp-down	Rate	6°C / sec max.
Time from 25°C to Peak Temperature		8 min max.
Composition of Solder paste		96.5 Sn/Ag/0.5Cu
Solder Paste Model		SHENMAO PF606 – P26

The graphic shows temperature profile for component assembly process in reflow ovens



\* All the temperature measurement points are on the component surface. If the temperature goes over the recommended value, it might cause component damage or peeling of the surface.

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## Soldering Condition

Soldering Iron temperature  $270^{\circ}\text{C} \pm 10^{\circ}\text{C}$

- i. The solder iron should be heated up to  $120^{\circ}\text{C}$  for 2-3 minutes.
- ii. Each terminal should be soldered within 3 seconds. If the temperature of the solder iron is over  $270^{\circ}\text{C} \pm 10^{\circ}\text{C}$  or if soldering takes more than 3 seconds, the component surface could peel off or the component could be damaged.
- iii. Soldering should be done with care to ensure that there are no short circuits or open paths for leakage of current.

## Reliability Tests

- i. Low-temperature test: Expose the specimen to  $-30^{\circ}\text{C}$  for 16 hours and then to normal temperature/ humidity for 24 hours or more. After this test, examine its appearance and functions.
- ii. High-temperature test: Expose the specimen to  $+85^{\circ}\text{C}$  for 16 hours and then to normal temperature/humidity for 24 hours or more. After this test, examine its appearance and functions.
- iii. High-temperature/ High-humidity test: Subject the object to the environmental conditions of  $+85^{\circ}\text{C}$  and 90 – 95 % R.H. for 96 hours, then expose to normal temperature/ humidity for 24 hours or more. After this test, examine its appearance and functions.
- iv. Thermal shock test: Subject the object to cyclic temperature change ( $-30^{\circ}\text{C}$ , 30 minutes  $\Leftrightarrow$   $+85^{\circ}\text{C}$ , 30 minutes) for 5 cycles, the expose to normal temperature/humidity for 24 hours or more.
- v. Vibration test:
  - Sinusoidal vibration test: Subject the object to vibrations of 5 to 200 to 5 Hz swept in 10 minutes, 4.5 G at maximum (2 mm amplitude), in X and Y directions for two hours each and in Z direction for four hours. After this test, examine its appearance functions.
  - Vibration test in packaged condition: Subject the object, which is packaged as illustrated, to vibrations of 15 to 60 to 15 Hz swept in 6 minutes, 4 G at maximum (2 mm amplitude at maximum), applied in X, Y and Z directions for two hours each, i.e. six hours in total. After this test, examine its appearance and functions.
- vi. Free fall test in packaged condition: Drop the object, which is packaged as illustrated, to a concrete surface from the height of 90 cm, on one comer, three edges and six faces once each, i.e. 10 times in total. After this, check the appearance and functions.
- vii. Soldering heat resistance test: After the lead pins of the unit are soaked in solder bath at  $270 \pm 5^{\circ}\text{C}$  for  $10 \pm 0.5$  seconds and then be left for more than 1 hour at  $25 \pm 5^{\circ}\text{C}$  in less than 65 % relative humidity.
- viii. Adhesion test: The device is subjected to be soldered on test PCB. Then apply 0.5 Kg (5 N) of force for  $10 \pm 1$  seconds in the direction parallel to the substrate. (The soldering should be done by reflow and be conducted with care so that the soldering is uniform and free of defect by stress such as heat shock).

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