Surface Acoustic Wave Based MEMS Resonator

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Introduction:SAW resonators are key component for Morden communication systems they are used as narrow band filter, oscillator, RFID tags, sensors etc. This SAW resonator presented here is designed for wireless communication which will be used as band pass filter with frequency 2.43 GHz.

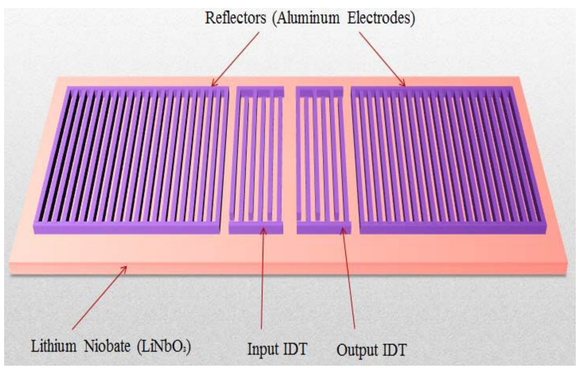

Figure 1. SAW Resonator

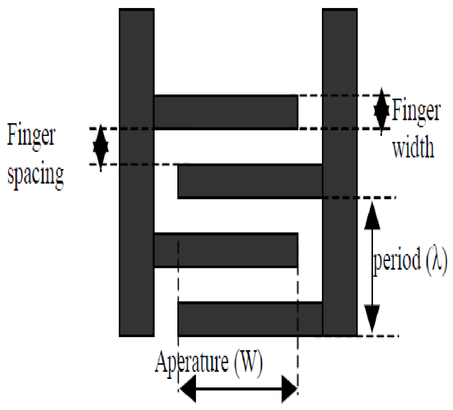

Figure 2. IDT

Computational Methods The reflectors array of shorted electrodes. Shorted electrodes have been proven to have less spurious effects compared to the open electrodes [2]. Hence, they are used. The period of the reflector is half of the wavelength (λ/2).

The relationship between resonance frequency and wave velocity is given by:

$$F = v/\lambda$$

The distance between the electrodes in the IDT is given by the relation:

$$\lambda = 2p$$

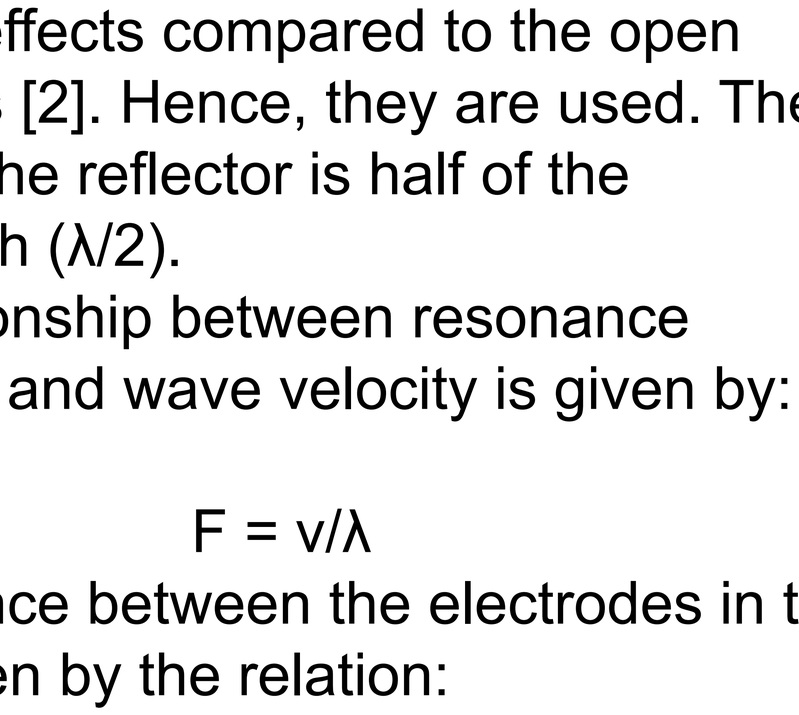

Figure . Key Design Parameter for resonator

Results : We have analysed the propagation of Rayleigh wave on YZ LiNb at 2.4 GHz. The geometry is drawn in 2D and piezoelectric physics is used. The piezoelectric substrate used is Lithium Niobate and Aluminium is used for IDT.

Since IDTs are periodic in nature consisting of positive and negative potential alternately, thus four electrodes are adequate to model two ports SAW resonator as whole. These electrodes function as two input and two output ports.

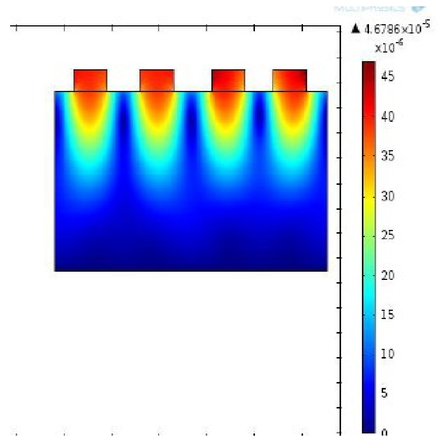

Figure 3.Frequency Domain Analysis

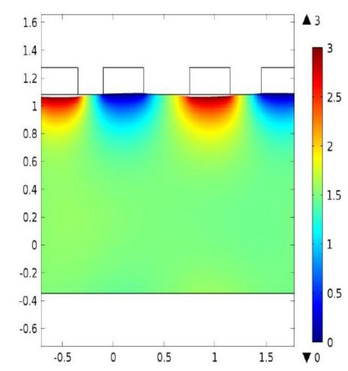

Figure 4. Potential Plot

Design Parameter	*Values*
Resonance frequency	2.43 GHz
Periodic distance IDT finger, λ	1.43 μm
Acoustic wave velocity, v	3488 m/s
Al thickness	0.02 μm
Total length	2.68 μm

Table 1.Design parameter

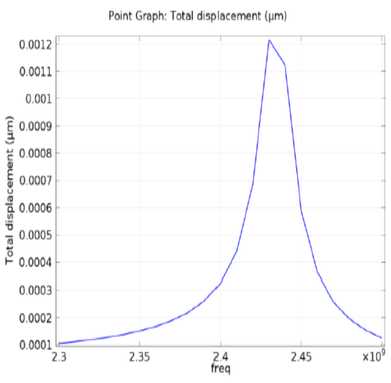

Figure 5. Resonance Plot

Conclusions: Simulation of SAW resonator at 2.43 GHz on Lithium Niobate was presented in this paper. The critical design parameter were calculated based on theoretical equations with few assumptions were made. The Resonance graph shows the band pass response. The bandwidth is 8.8 MHz and the Quality factor is 278

References:

1. C. K. Campbell, “Surface Acoustic Wave Devices for Mobile and Wireless Communications”, San Diego: Academic Press Inc., 1998.
2. S. Datta, “Surface Acoustic Wave Devices”, New Jersey: Prentice Hall, 1986
3. H. Campanella, “Acoustic Waves and Electromechanical Resonators”, Norwood: Artech House, 2010