



US 20220368312A1

(19) **United States**(12) **Patent Application Publication**  
**Wang et al.**(10) **Pub. No.: US 2022/0368312 A1**(43) **Pub. Date: Nov. 17, 2022**(54) **BULK ACOUSTIC WAVE RESONATOR WITH  
OXIDE RAISED FRAME**(52) **U.S. Cl.**CPC ..... *H03H 9/605* (2013.01); *H03H 9/205*  
(2013.01); *H03H 9/02086* (2013.01)(71) Applicant: **SKYWORKS GLOBAL PTE. LTD.**,  
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(57)

**ABSTRACT**

A ladder filter comprises series arm bulk acoustic wave resonators electrically connected in series between an input port and an output port and shunt bulk acoustic wave resonators electrically connected between adjacent ones of the series arm bulk acoustic wave resonators and ground, each of the arm bulk acoustic resonators including a central active region and a raised frame region outside of the central active region, each of the series arm bulk acoustic resonators including a piezoelectric film, at least one of the series arm bulk acoustic wave resonators including a layer of oxide disposed directly on the piezoelectric film in the raised frame region, and a metal layer disposed directly on the piezoelectric film in the central active region and on the layer of oxide in the raised frame region, the metal layer having a thickness in the raised frame region no greater than in the central active region.

(21) Appl. No.: **17/662,686**(22) Filed: **May 10, 2022****Related U.S. Application Data**

(60) Provisional application No. 63/188,734, filed on May 14, 2021.

**Publication Classification**(51) **Int. Cl.***H03H 9/60* (2006.01)*H03H 9/205* (2006.01)*H03H 9/02* (2006.01)