



US 20220399871A1

(19) **United States**

(12) **Patent Application Publication**  
**Goto et al.**

(10) **Pub. No.: US 2022/0399871 A1**

(43) **Pub. Date: Dec. 15, 2022**

(54) **MULTILAYER PIEZOELECTRIC  
SUBSTRATE FOR ACOUSTIC WAVE DEVICE**

**Publication Classification**

(71) Applicant: **Skyworks Solutions, Inc.**, Irvine, CA  
(US)

(51) **Int. Cl.**  
*H03H 9/02* (2006.01)  
*H03H 9/64* (2006.01)  
*H03H 9/145* (2006.01)  
*H01L 41/187* (2006.01)

(72) Inventors: **Rei Goto**, Osaka-shi (JP); **Keiichi  
Maki**, Suita-shi (JP); **Gong Bin Tang**,  
Moriguchi-shi (JP)

(52) **U.S. Cl.**  
CPC .... *H03H 9/02551* (2013.01); *H03H 9/02582*  
(2013.01); *H03H 9/02574* (2013.01); *H03H*  
*9/64* (2013.01); *H03H 9/145* (2013.01); *H01L*  
*41/1873* (2013.01)

(21) Appl. No.: **17/664,027**

(57) **ABSTRACT**

(22) Filed: **May 18, 2022**

A surface acoustic wave device has a piezoelectric substrate having a cut angle (e.g., the piezoelectric angle is cut so as to have a crystal orientation) that allows the surface acoustic wave device to operate as a longitudinally leaky surface acoustic wave device that confines the acoustic wave energy within the piezoelectric substrate and that has less propagation attenuation and a higher electromechanical coupling coefficient  $k^2$ .

**Related U.S. Application Data**

(60) Provisional application No. 63/202,531, filed on Jun. 15, 2021, provisional application No. 63/202,532, filed on Jun. 15, 2021.

