



US 20220360159A1

(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2022/0360159 A1**  
(43) **Pub. Date: Nov. 10, 2022**(54) **HARVESTING RINGING ENERGY**(71) Applicant: **Qualcomm Incorporated**, San Diego, CA (US)(72) Inventors: **Troy Lynn Stockstad**, Chandler, AZ (US); **Yi-Cheng Wan**, Singapore (SG); **Marko Koski**, Chandler, AZ (US); **Ajay Kumar Kosaraju**, Singapore (SG)(21) Appl. No.: **17/315,444**(22) Filed: **May 10, 2021****Publication Classification**(51) **Int. Cl.**  
**H02M 1/00** (2006.01)  
**H02M 1/08** (2006.01)  
**H02M 3/158** (2006.01)(52) **U.S. Cl.**CPC ..... **H02M 1/0006** (2021.05); **H02M 1/08** (2013.01); **H02M 3/1582** (2013.01)

(57)

**ABSTRACT**

An apparatus is disclosed for harvesting ringing energy. In an example aspect, the apparatus includes a bootstrap circuit. The bootstrap circuit includes a bootstrap capacitor and a bootstrap switch. The bootstrap switch includes a first terminal configured to accept an input voltage. The bootstrap switch also includes a second terminal coupled to the bootstrap capacitor. The bootstrap switch additionally includes a body diode comprising an anode coupled to the first terminal and a cathode coupled to the second terminal. The bootstrap switch is configured to be in an open state to charge the bootstrap capacitor via the body diode. The bootstrap switch is also configured to provide a voltage at the second terminal of the bootstrap switch. The voltage is greater than an average of the input voltage.

