



US 20220360218A1

(19) **United States**(12) **Patent Application Publication**

Arft et al.

(10) **Pub. No.: US 2022/0360218 A1**(43) **Pub. Date: Nov. 10, 2022**(54) **OVENIZED MEMS****B81B 3/00** (2006.01)**H01L 23/00** (2006.01)(71) Applicant: **SiTime Corporation**, Santa Clara, CA (US)(52) **U.S. Cl.**CPC **H03B 5/04** (2013.01); **H03B 5/30** (2013.01); **H01L 23/3121** (2013.01); **H01L 23/345** (2013.01); **B81B 3/0081** (2013.01); **H01L 24/16** (2013.01); **H01L 2924/1461** (2013.01); **H01L 2224/16145** (2013.01); **B81B 2207/012** (2013.01); **B81B 2207/098** (2013.01)(72) Inventors: **Carl Arft**, Ann Arbor, MI (US); **Aaron Partridge**, Cupertino, CA (US); **Markus Lutz**, Mountain View, CA (US); **Charles I. Grosjean**, Los Gatos, CA (US)

(57)

ABSTRACT

One or more heating elements are provided to heat a MEMS component (such as a resonator) to a temperature higher than an ambient temperature range in which the MEMS component is intended to operate—in effect, heating the MEMS component and optionally related circuitry to a steady-state “oven” temperature above that which would occur naturally during component operation and thereby avoiding temperature-dependent performance variance/instability (frequency, voltage, propagation delay, etc.). In a number of embodiments, an IC package is implemented with distinct temperature-isolated and temperature-interfaced regions, the former bearing or housing the MEMS component and subject to heating (i.e., to oven temperature) by the one or more heating elements while the latter is provided with (e.g., disposed adjacent) one or more heat dissipation paths to discharge heat generated by transistor circuitry (i.e., expel heat from the integrated circuit package).

(21) Appl. No.: **17/824,389**(22) Filed: **May 25, 2022****Related U.S. Application Data**

(62) Division of application No. 16/699,270, filed on Nov. 29, 2019, now Pat. No. 11,374,535.

(60) Provisional application No. 62/776,417, filed on Dec. 6, 2018.

Publication Classification(51) **Int. Cl.****H03B 5/04** (2006.01)**H03B 5/30** (2006.01)**H01L 23/31** (2006.01)**H01L 23/34** (2006.01)