



US 20220407489A1

(19) **United States**(12) **Patent Application Publication**  
**WATANABE et al.**(10) **Pub. No.: US 2022/0407489 A1**(43) **Pub. Date: Dec. 22, 2022**(54) **HIGH FREQUENCY FILTER**(71) Applicant: **Mitsubishi Electric Corporation,**  
Tokyo (JP)(72) Inventors: **Motomi WATANABE,** Tokyo (JP);  
**Yukihiro HOMMA,** Tokyo (JP);  
**Tomohiro TAKAHASHI,** Tokyo (JP);  
**Shinji ARAI,** Tokyo (JP); **Kenji**  
**HARAUCHI,** Tokyo (JP); **Hidegori**  
**YUKAWA,** Tokyo (JP)(73) Assignee: **Mitsubishi Electric Corporation,**  
Tokyo (JP)(21) Appl. No.: **17/880,209**(22) Filed: **Aug. 3, 2022****Related U.S. Application Data**(63) Continuation of application No. PCT/JP2020/  
013533, filed on Mar. 26, 2020.**Publication Classification**(51) **Int. Cl.**  
**H03H 7/075** (2006.01)  
**H05K 3/46** (2006.01)**H05K 1/02** (2006.01)**H05K 1/11** (2006.01)**H01P 3/08** (2006.01)**H05K 3/34** (2006.01)(52) **U.S. Cl.**CPC ..... **H03H 7/075** (2013.01); **H05K 3/46**  
(2013.01); **H05K 1/0251** (2013.01); **H05K**  
**1/116** (2013.01); **H01P 3/08** (2013.01); **H05K**  
**3/34** (2013.01); **H05K 2201/09372** (2013.01)

(57)

**ABSTRACT**

A high frequency filter includes: a multilayer substrate including a first substrate for which lands are provided, a second substrate for which lands are provided, and a third substrate for which lands are provided, the third substrate being sandwiched between the first substrate and the second substrate; a columnar conductor electrically connected to the lands in the multilayer substrate; and columnar conductors provided to surround the columnar conductor, electrically connected to a ground plane of the first substrate, and electrically connected to a ground plane of the second substrate. The spacing between the lands of the first substrate and the lands of the third substrate and the spacing between the lands of the second substrate and the lands of the third substrate are electrical lengths of 90 degrees or less at the cutoff frequency.

