



US009326381B2

(12) **United States Patent**  
**Lee et al.**

(10) **Patent No.:** **US 9,326,381 B2**  
(45) **Date of Patent:** **Apr. 26, 2016**

(54) **MULTILAYER CERAMIC CAPACITOR AND BOARD HAVING THE SAME MOUNTED THEREON**

USPC ..... 361/301.4, 303-305, 306.1, 306.3, 361/321.1, 321.2  
See application file for complete search history.

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(57) **ABSTRACT**

A multilayer ceramic capacitor may include: a ceramic body including dielectric layers and having first and second main surfaces opposing each other, first and second side surfaces opposing each other, and first and second end surfaces opposing each other; an active layer configured to form capacitance by including first and second internal electrodes facing each other with one dielectric layer therebetween and alternately exposed to the first or second side surface; upper and lower cover layers disposed on and below the active layer; and a first external electrode disposed on the first side surface and a second external electrode disposed on the second side surface. Thickness T and width W of the ceramic body satisfy  $0.75W \leq T \leq 1.25W$ , gap G between the first and second external electrodes satisfies  $30 \mu\text{m} \leq G \leq 0.9W$ , and an average number of dielectric grains in a single dielectric layer in a thickness direction thereof is 2 or greater.

**19 Claims, 5 Drawing Sheets**

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(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 197 days.

(21) Appl. No.: **14/259,011**

(22) Filed: **Apr. 22, 2014**

(65) **Prior Publication Data**

US 2014/0367152 A1 Dec. 18, 2014

(30) **Foreign Application Priority Data**

Jun. 14, 2013 (KR) ..... 10-2013-0068498

(51) **Int. Cl.**  
**H01G 4/30** (2006.01)  
**H05K 1/11** (2006.01)

(Continued)

(52) **U.S. Cl.**  
CPC ..... **H05K 1/111** (2013.01); **H01G 4/1209** (2013.01); **H01G 4/232** (2013.01); **H01G 4/30** (2013.01);

(Continued)

(58) **Field of Classification Search**  
CPC ..... H01G 4/30; H01G 4/06; H01G 4/12; H01G 4/005; H01G 4/008

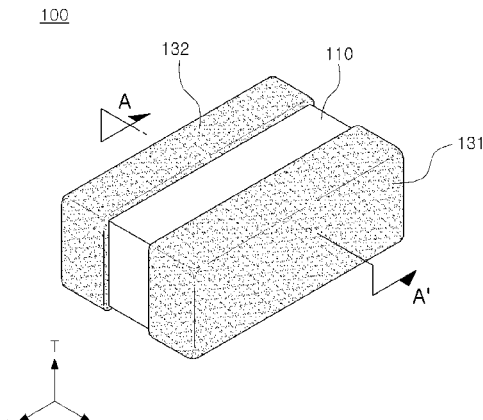


Exhibit 1001

(51)	<b>Int. Cl.</b> <i>H01G 4/232</i> (2006.01) <i>H05K 3/34</i> (2006.01) <i>H01G 4/12</i> (2006.01)	8,383,535 B2 * 2/2013 Yamaguchi ..... C04B 35/46 361/321.4 8,437,115 B2 * 5/2013 Kim ..... H01G 4/30 361/305 8,737,037 B2 * 5/2014 Kim ..... H01G 4/0085 361/305
(52)	<b>U.S. Cl.</b> CPC ..... <i>H01G 4/12</i> (2013.01); <i>H05K 3/3442</i> (2013.01); <i>H05K 2201/0979</i> (2013.01); <i>H05K</i> <i>2201/09709</i> (2013.01); <i>H05K 2201/10015</i> (2013.01); <i>H05K 2201/2045</i> (2013.01); <i>Y02P</i> <i>70/611</i> (2015.11)	9,009,240 B2 * 4/2015 Milic-Frayling ..... G06Q 10/10 370/432 9,129,750 B2 * 9/2015 Kim ..... H01G 4/1209 2008/0310074 A1 12/2008 Togashi et al. 2008/0310078 A1 12/2008 Lee et al.

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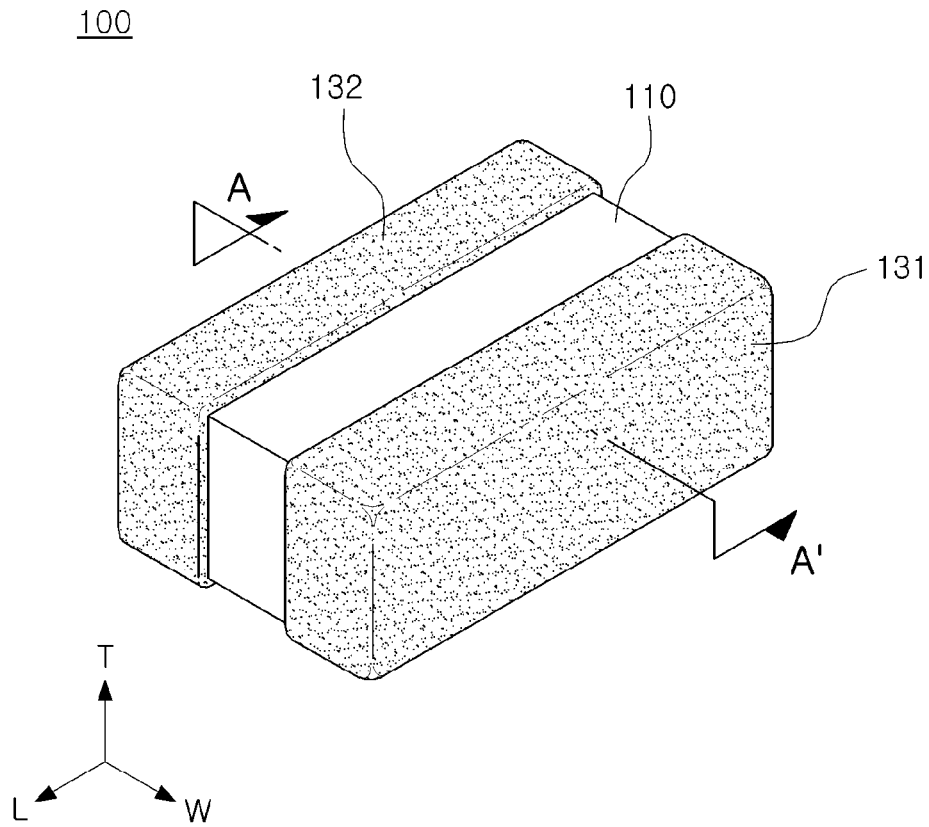


FIG. 1

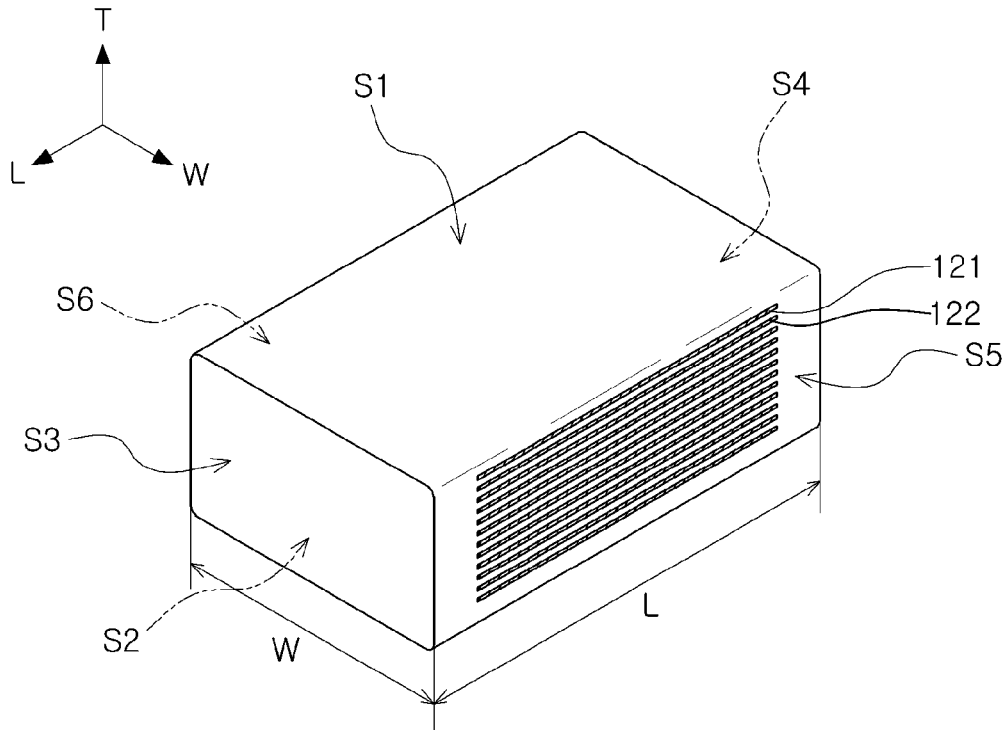


FIG. 2

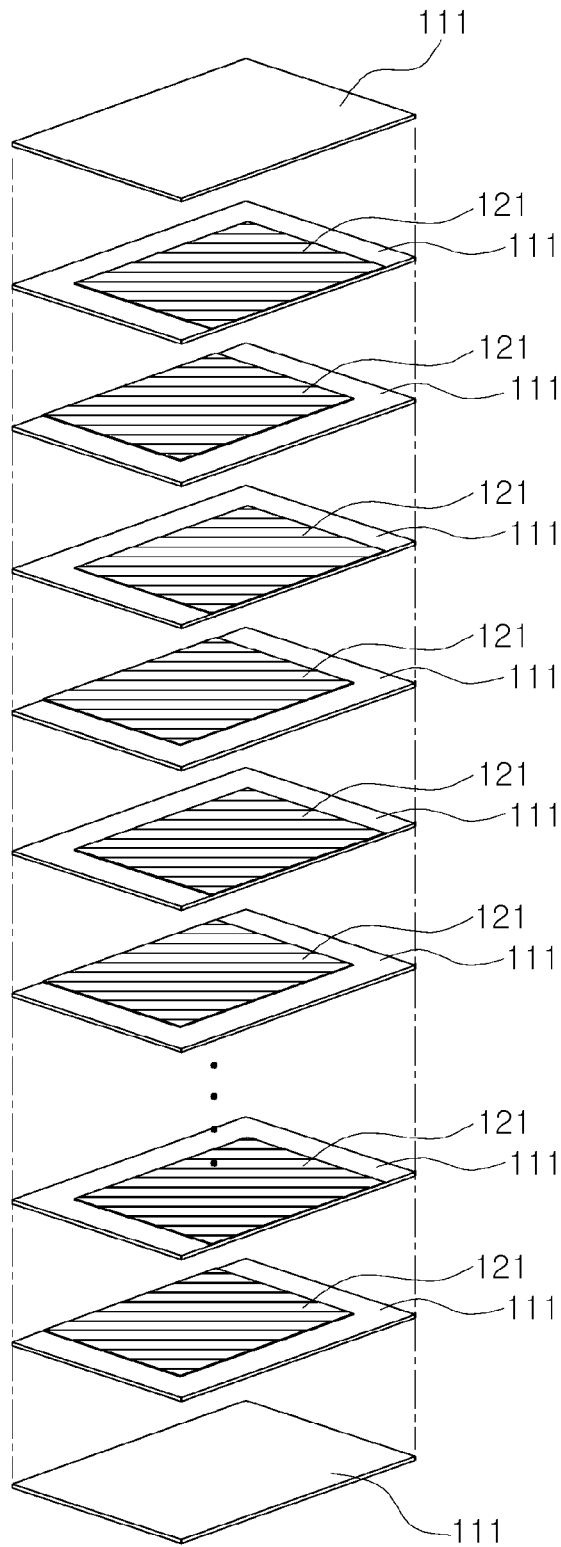


FIG. 3

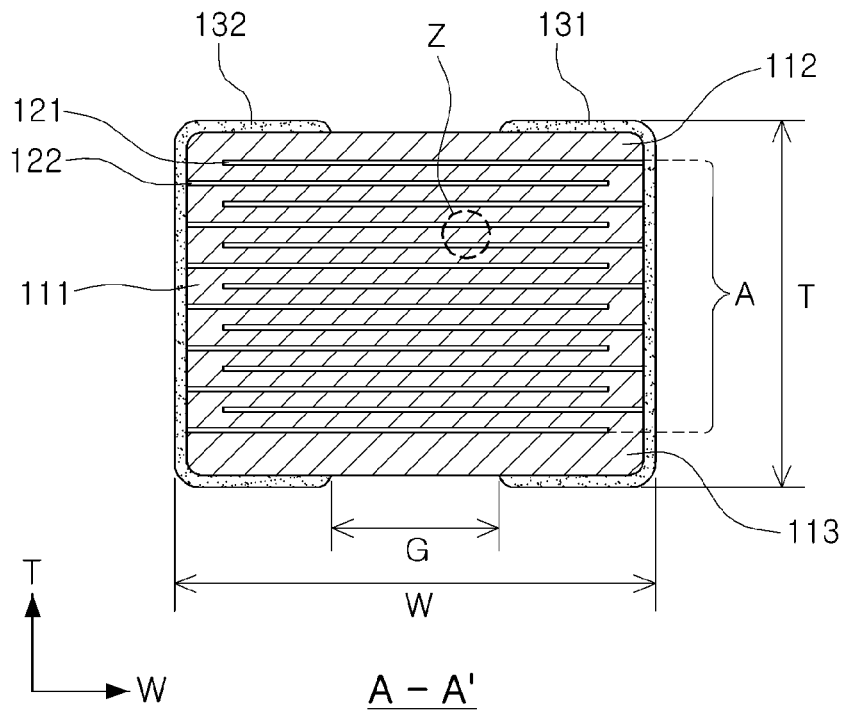
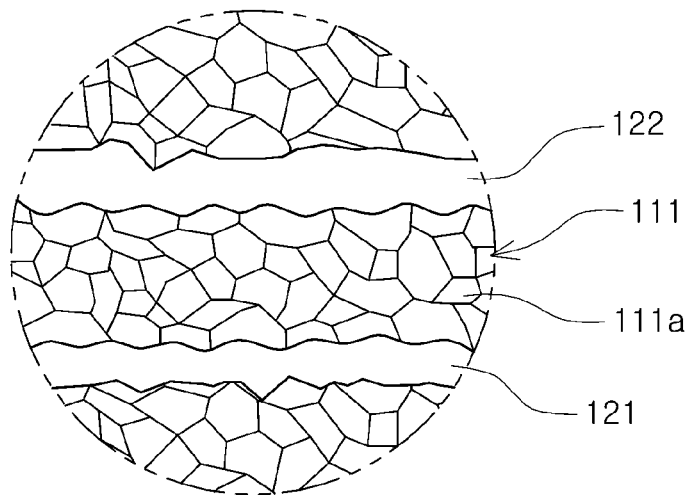


FIG. 4



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FIG. 5

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