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(12) **United States Patent**
Maharyta

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(54) **METHODS AND CIRCUITS FOR MEASURING MUTUAL AND SELF CAPACITANCE**

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2012/0043971 A1 2/2012 Maharyta
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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 240 days.

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(21) Appl. No.: **12/606,147**

(22) Filed: **Oct. 26, 2009**

Related U.S. Application Data

(63) Continuation-in-part of application No. 12/395,462, filed on Feb. 27, 2009.

(60) Provisional application No. 61/108,450, filed on Oct. 24, 2008.

(Continued)

(51) **Int. Cl.**
G01R 27/26 (2006.01)

Primary Examiner — Minh N Tang

(52) **U.S. Cl.** **324/658**; 324/678

(58) **Field of Classification Search** None
See application file for complete search history.

(57) **ABSTRACT**

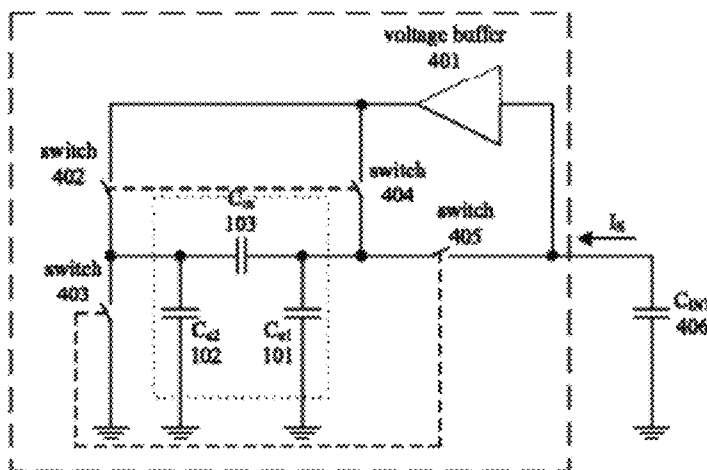
Capacitance measurement circuits for measuring self and mutual capacitances are described. In one embodiment the capacitance measurement circuit includes: a first electrode capacitively coupled with a second electrode; a first plurality of switches coupled with the first electrode; and a second plurality of switches coupled with the second electrode, wherein, during a first operation stage, the first plurality of switches is configured to apply a first initial voltage to the first electrode and the second plurality of switches is configured to apply a second initial voltage to the second electrode, and wherein, during a second operation stage, the first plurality of switches is configured to connect the first electrode with a measurement circuit, and the second plurality of switches is configured to connect the second electrode with a constant voltage.

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23 Claims, 18 Drawing Sheets



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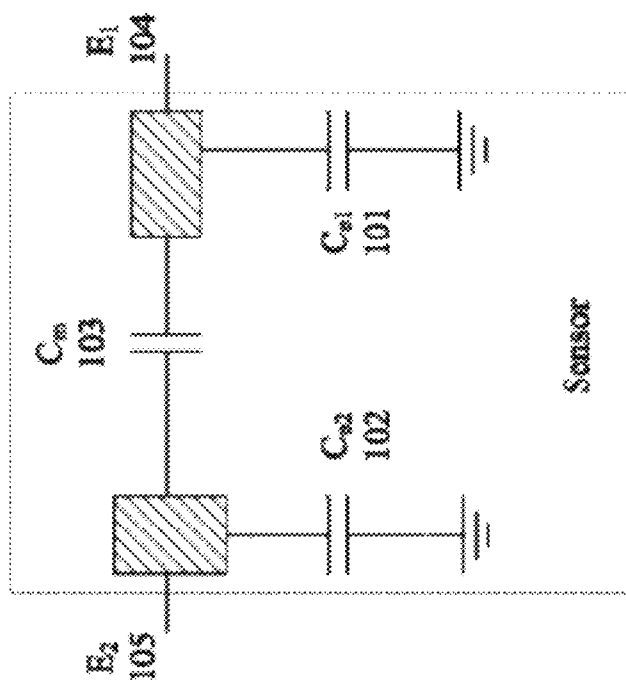


FIGURE 1

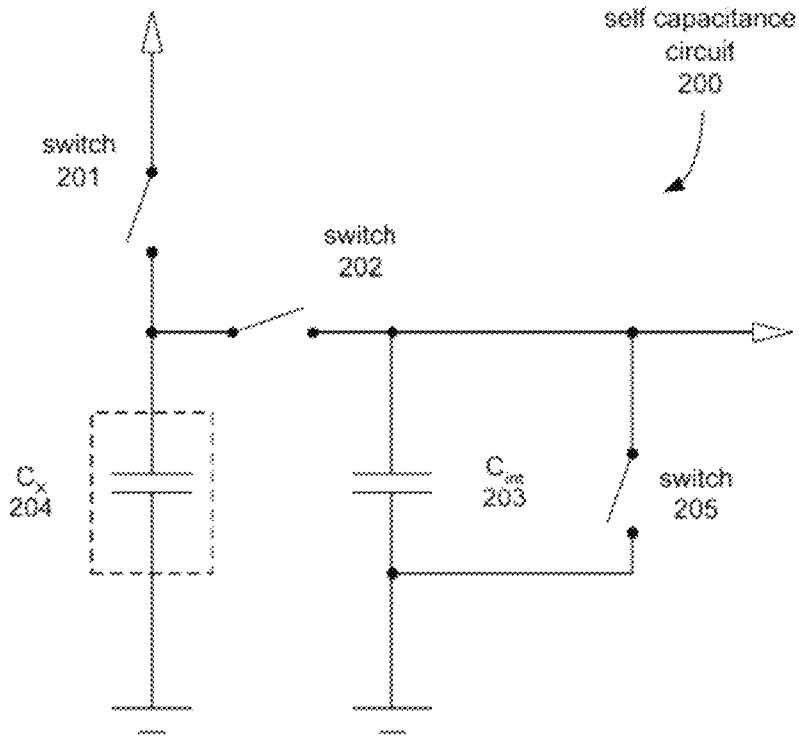


FIGURE 2

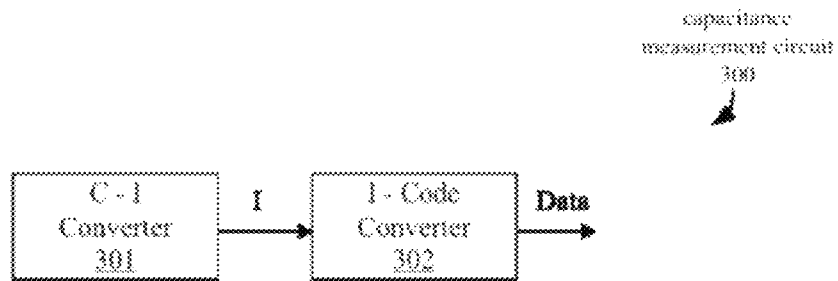


FIGURE 3

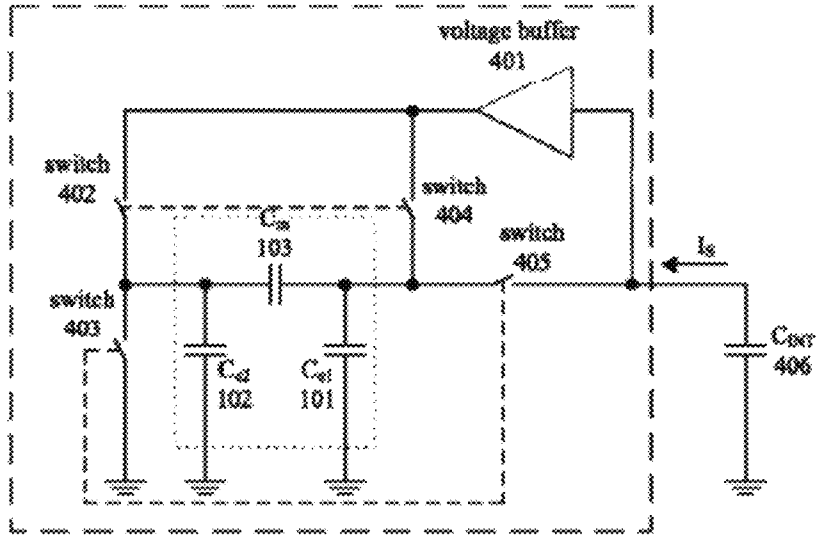


FIGURE 4A

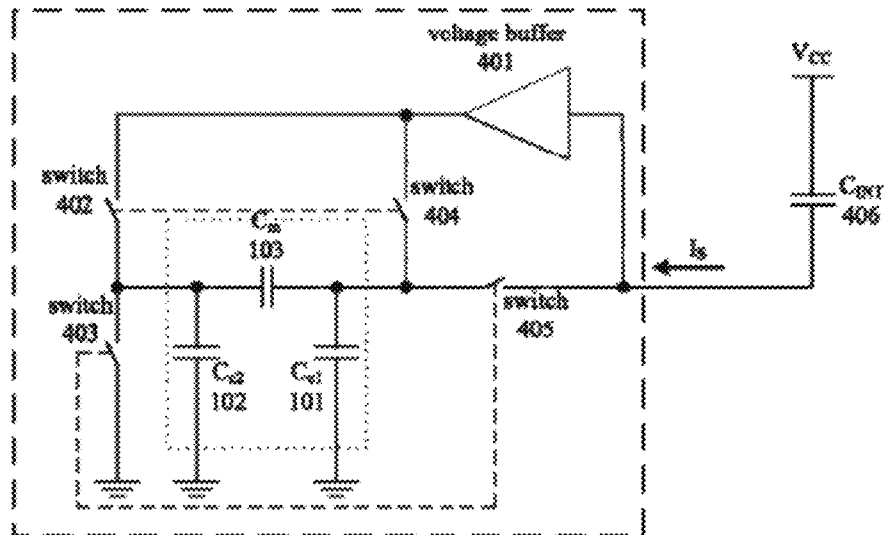


FIGURE 4B

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