

(12) **United States Patent**  
**Hayashi**

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(54) **SEMICONDUCTOR DEVICE HAVING  
INTERNAL VOLTAGE GENERATING  
CIRCUIT**

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307/505 (2015.04); Y10T 307/675 (2015.04)

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

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(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
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**Related U.S. Application Data**

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(57) **ABSTRACT**

A semiconductor device including a first internal voltage  
generating circuit that includes a capacitor including a first  
electrode and a second electrode, and the first internal voltage  
generating circuit to generate an internal voltage by charging  
the capacitor to a first voltage and applying a second voltage  
to the first electrode of the capacitor to generate a third volt-  
age that is greater than the first and the second voltages on the  
second electrode in absolute value, and a control circuit to  
perform a control by applying a fourth voltage that is less than  
the first voltage to the capacitor when the first internal voltage  
generating circuit is in a standby state.

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(52) **U.S. Cl.**  
CPC ..... **G05F 1/465** (2013.01); **H02M 3/07**  
(2013.01); **H02M 2001/0032** (2013.01); **Y02B**

**13 Claims, 10 Drawing Sheets**

