



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

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(54) **SEMICONDUCTOR DEVICE HAVING PENETRATING ELECTRODES EACH PENETRATING THROUGH SUBSTRATE**

23/5226; H01L 23/481; G01R 31/3187; G11C 29/1201; G11C 5/063; G11C 5/025
See application file for complete search history.

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(57) **ABSTRACT**

(51) **Int. Cl.**

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G11C 5/02	(2006.01)
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G11C 29/12	(2006.01)

Disclosed herein is a device that includes a semiconductor substrate, a check circuit and a through-substrate via. The check circuit includes a check line formed over the semiconductor substrate and including first and second parts each extending in a first direction and a third part extending in a second direction that crosses the first direction, the first and second parts being opposite to each other, the third part connecting one end of the first part with one end of the second part, a charge circuit coupled to a one end of the check line, and a comparator coupled to the other end of the check line at a first input node thereof. The through-substrate via penetrates through the semiconductor substrate and is located in an area that is between the first and second parts of the check line.

(52) **U.S. Cl.**

CPC **G01R 31/3187** (2013.01); **G11C 5/025** (2013.01); **G11C 5/063** (2013.01); **G11C 29/1201** (2013.01)

(58) **Field of Classification Search**

CPC H01L 2225/06517; H01L 2225/06513; H01L 2225/06544; H01L 2225/06596; H01L

20 Claims, 12 Drawing Sheets

