

# EXHIBIT D

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

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 (45) **Date of Patent:** **Nov. 16, 2004**

(54) **MULTIMODE DATA BUFFER AND METHOD FOR CONTROLLING PROPAGATION DELAY TIME**

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(73) Assignee: **Samsung Electronics Co., Ltd.**, Kyungki-Do (KR)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 77 days.

(21) Appl. No.: **10/278,071**

(22) Filed: **Oct. 23, 2002**

(65) **Prior Publication Data**

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**Related U.S. Application Data**

(60) Provisional application No. 60/379,665, filed on May 10, 2002.

(51) **Int. Cl.**<sup>7</sup> ..... **G11C 7/00**

(52) **U.S. Cl.** ..... **365/193; 365/189.05; 365/191; 365/194**

(58) **Field of Search** ..... **365/189.05, 191, 365/193, 194**

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(57) **ABSTRACT**

A data buffer, such as a data strobe input buffer or a data input buffer, which may operate in multiple modes, such as a single mode (SM) and a dual mode (DM) and where the mode is selected by providing a signal, such as an external signal such as an address signal or an external command signal. A data buffer which can be used for a SM/DM dual-use and can improve a data setup/hold margin. A semiconductor memory device including one or more of the data buffers described above. A method for controlling propagation delay times which can improve a data setup/hold margin in a SM/DM dual-use data buffer.

**29 Claims, 13 Drawing Sheets**

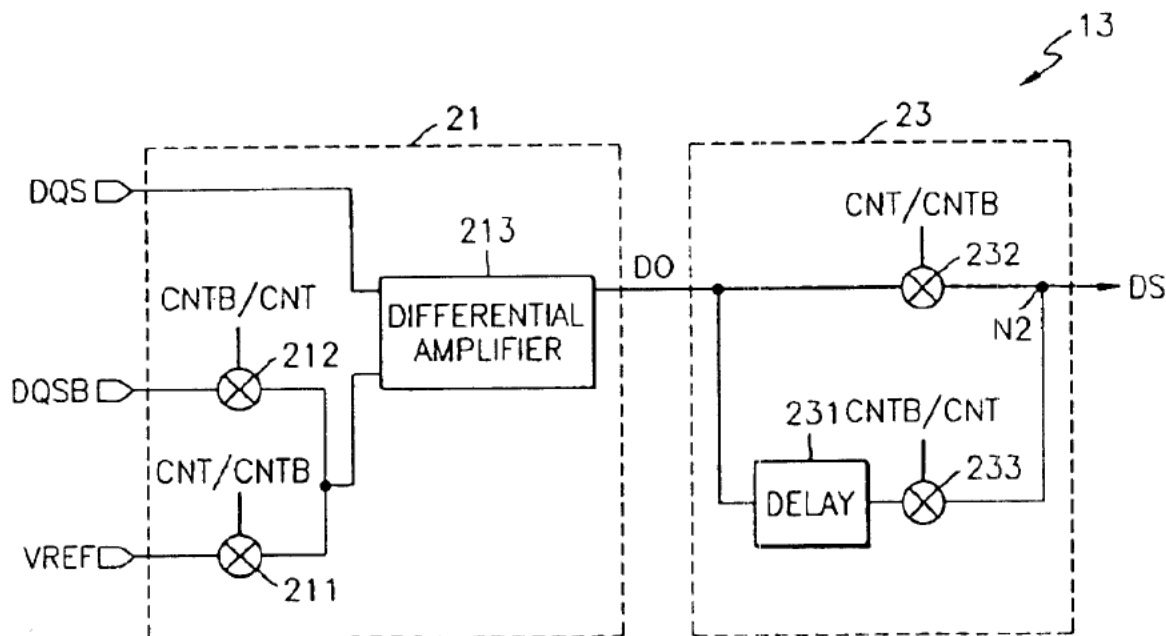


FIG. 1 Prior Art

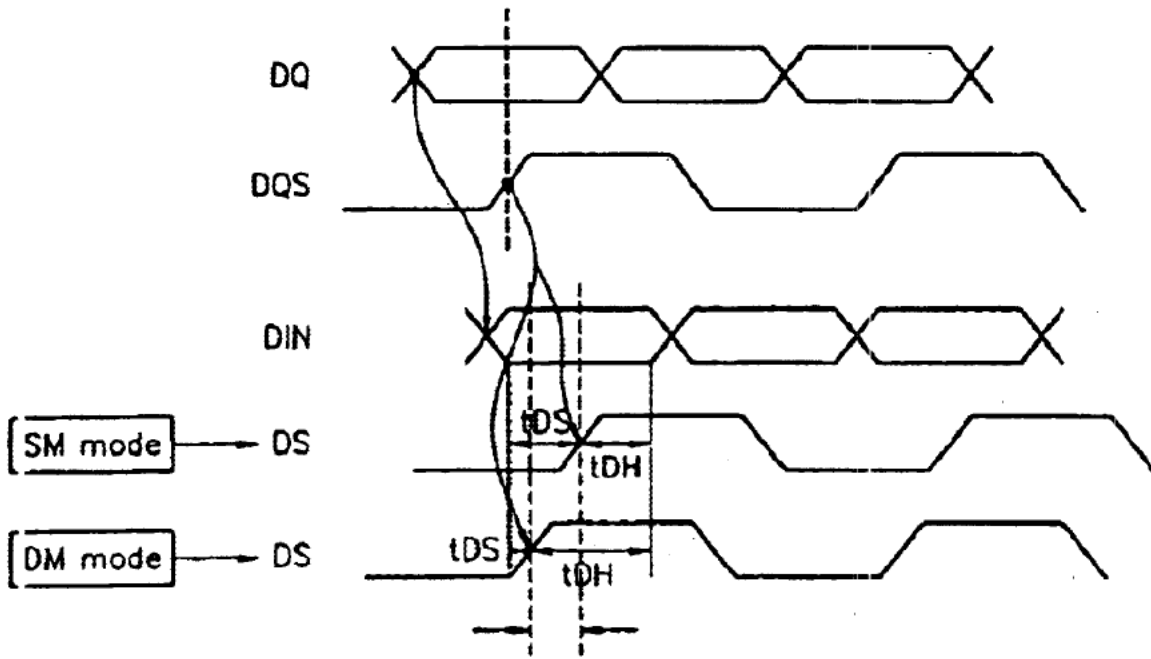


FIG. 2

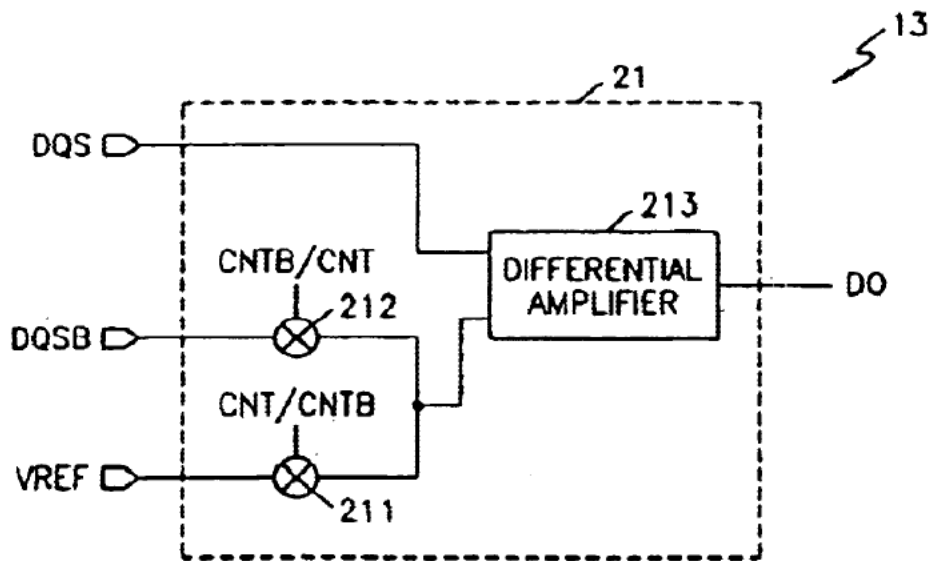


FIG. 3A

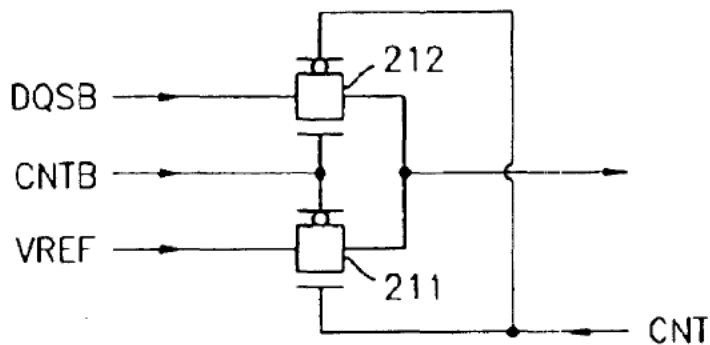


FIG. 3B



FIG. 4

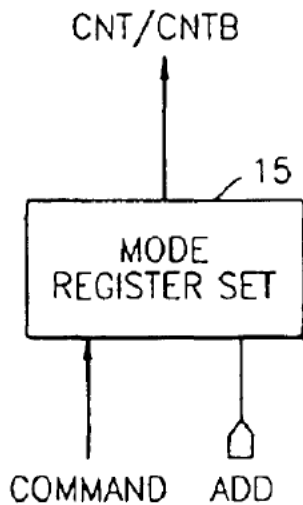


FIG. 5A

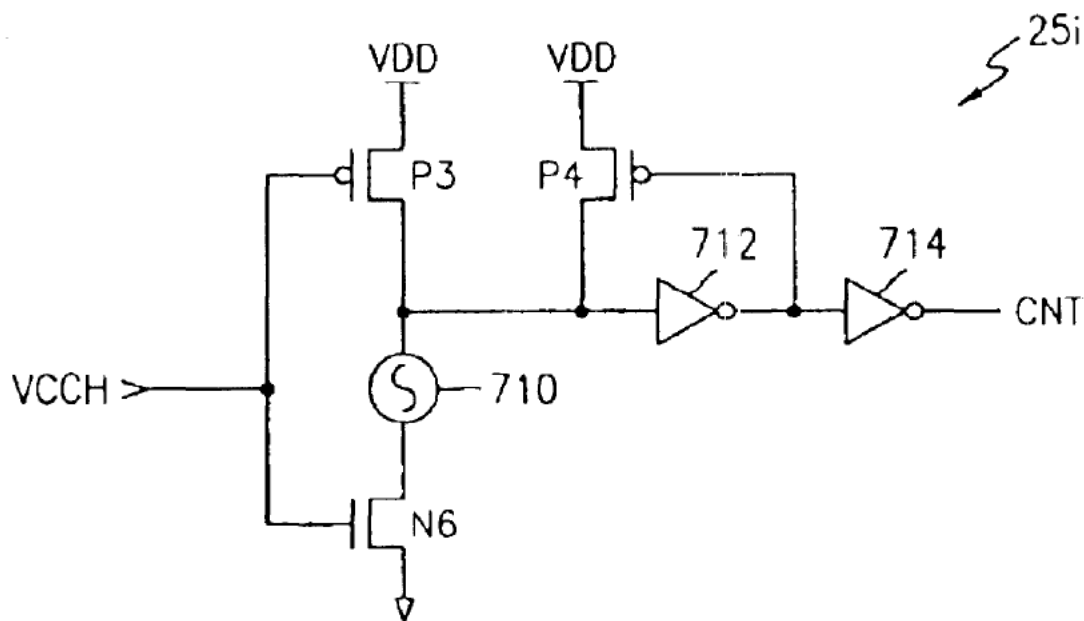
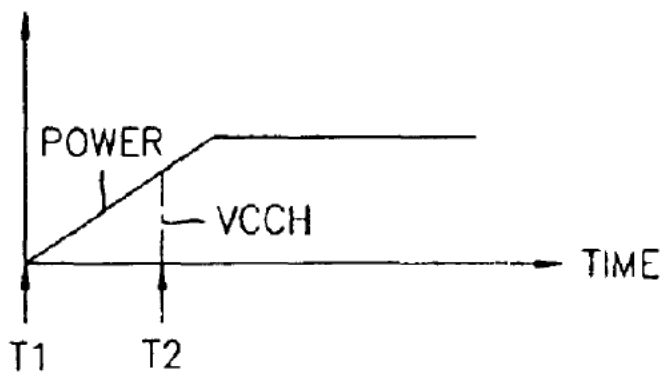


FIG. 5B

VOLTAGE LEVEL



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