US007532537B2

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

(10) **Patent No.: US 7,532,537 B2**
(45) **Date of Patent: May 12, 2009**

(54) **MEMORY MODULE WITH A CIRCUIT PROVIDING LOAD ISOLATION AND MEMORY DOMAIN TRANSLATION**

(75) Inventors: **Jeffrey C. Solomon**, Irvine, CA (US); **Jayesh R. Bhakta**, Cerritos, CA (US)

(73) Assignee: **Netlist, Inc.**, Irvine, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 170 days.

(21) Appl. No.: **11/335,875**

(22) Filed: **Jan. 19, 2006**

(65) **Prior Publication Data**

US 2006/0262586 A1 Nov. 23, 2006

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/173,175, filed on Jul. 1, 2005, now Pat. No. 7,289,386, which is a continuation-in-part of application No. 11/075,395, filed on Mar. 7, 2005, now Pat. No. 7,286,436.

(60) Provisional application No. 60/645,087, filed on Jan. 19, 2005, provisional application No. 60/588,244, filed on Jul. 15, 2004, provisional application No. 60/550,668, filed on Mar. 5, 2004, provisional application No. 60/575,595, filed on May 28, 2004, provisional application No. 60/590,038, filed on Jul. 21, 2004.

(51) **Int. Cl.**
G11C 8/00 (2006.01)

(52) **U.S. Cl.** **365/230.06**; 365/51; 365/233.13

(58) **Field of Classification Search** 365/51, 365/52, 191, 230.03, 230.06, 230.08, 233.1, 365/233.13

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,392,212	A	7/1983	Miyasaka et al.
5,247,643	A	9/1993	Shottan
5,426,753	A	6/1995	Moon
5,581,498	A	12/1996	Ludwig et al.
5,703,826	A	12/1997	Hush et al.
5,745,914	A	4/1998	Connolly et al.
5,802,395	A	9/1998	Connolly et al.
5,805,520	A	9/1998	Anglada et al.
5,926,827	A	7/1999	Dell et al.

(Continued)

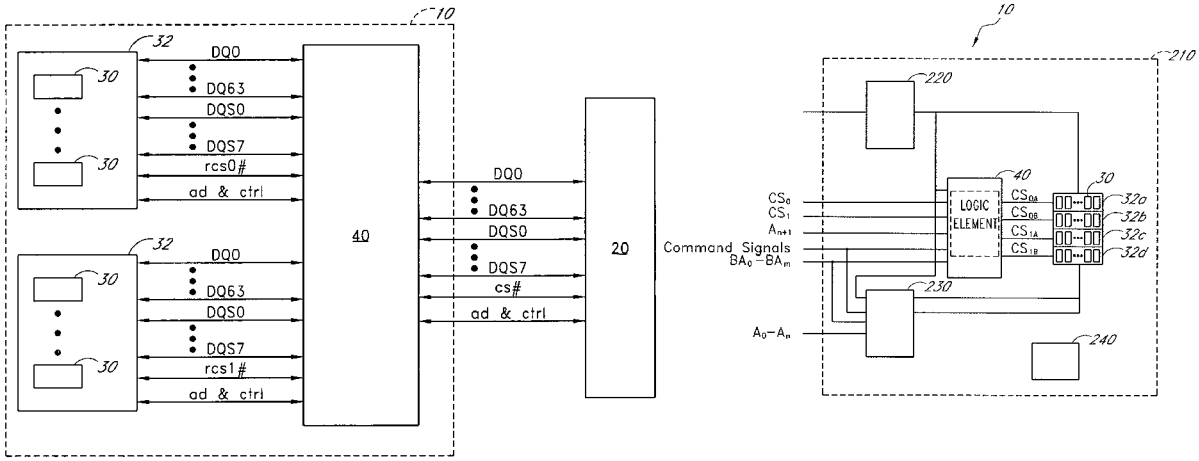
OTHER PUBLICATIONS

Barr, Michael. "Programmable Logic: What's it To Ya?," Embedded Systems Programming, Jun. 1999, pp. 75-84. Retrieved by Examiner from http://www.netrino.com/Articles/ProgrammableLogic/index.php.*

(Continued)

Primary Examiner—Van Thu Nguyen
Assistant Examiner—Alexander Sofocleous
(74) *Attorney, Agent, or Firm*—Knobbe, Martens, Olson & Bear, LLP

(57) **ABSTRACT**

A memory module includes a plurality of memory devices and a circuit. Each memory device has a corresponding load. The circuit is electrically coupled to the plurality of memory devices and is configured to be electrically coupled to a memory controller of a computer system. The circuit selectively isolates one or more of the loads of the memory devices from the computer system. The circuit comprises logic which translates between a system memory domain of the computer system and a physical memory domain of the memory module.

44 Claims, 23 Drawing Sheets