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(54) **MULTI-STAGE DIGITAL-TO-ANALOG CONVERTER**

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(58) **Field of Classification Search** **341/146, 341/144, 145, 153**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,202,042	A *	5/1980	Connors et al.	341/144
4,918,448	A *	4/1990	Hauviller et al.	341/145
5,257,027	A *	10/1993	Murota	341/153

5,489,904	A *	2/1996	Hadidi	341/156
5,745,064	A *	4/1998	Ohya	341/144
5,748,128	A *	5/1998	Bruccoleri et al.	341/144
5,914,682	A *	6/1999	Noguchi	341/145
6,466,149	B1 *	10/2002	Tabler	341/144
2002/0024454	A1 *	2/2002	Bartlett	

OTHER PUBLICATIONS

Brownlow et al. (PGPub 2002/0041245), Digital to analog converter and active matrix liquid crystal display, published Apr. 11, 2002.*

* cited by examiner

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(57) **ABSTRACT**

A multi-stage digital-to-analog converter has been presented. The multi-stage digital-to-analog converter may include a first digital-to-analog stage to output a first voltage and a second voltage in response to a first portion of a digital value, the first voltage being greater than the second voltage by a predetermined value, and a second digital-to-analog stage coupled to the first digital-to-analog stage to receive the first voltage and the second voltage and to generate a third voltage in between the first and the second voltages in response to a second portion of the digital value.

16 Claims, 4 Drawing Sheets

