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Aoi

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(54) METHOD FOR FORMING INTERCONNECTION STRUCTURE

0 680 085 A1 11/1995 (EP) .
06-291193 10/1994 (JP) .
07-153842 6/1995 (JP) .
09-064034 3/1997 (JP) .
09-153545 6/1997 (JP) .

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(21) Appl. No.: 09/756,242

(22) Filed: Jan. 9, 2001

Related U.S. Application Data

(63) Continuation of application No. 09/274,114, filed on Mar. 23, 1999, now Pat. No. 6,197,696.

(30) Foreign Application Priority Data

Mar. 26, 1998 (JP) 10-079371
(51) Int. Cl.⁷ **H01L 21/311; H01L 21/3065**
(52) U.S. Cl. **438/700; 438/706; 438/723; 438/725**
(58) Field of Search **438/700, 706, 438/723, 725**

(56) References Cited

U.S. PATENT DOCUMENTS

5,110,712	5/1992	Kessler et al.	438/623
5,518,963	5/1996	Park	438/624
5,635,423	6/1997	Huang et al.	438/638
5,651,855	7/1997	Dennison et al.	438/628
5,702,982	12/1997	Lee et al.	438/620
6,077,769 *	6/2000	Huang et al.	438/622
6,083,822 *	7/2000	Lee	438/624
6,197,696 *	3/2001	Aoi	438/700
6,222,255 *	4/2001	Han	257/622

FOREIGN PATENT DOCUMENTS

0 425 787 A2 5/1991 (EP) .

OTHER PUBLICATIONS

European Search Report dated Jul. 1, 1999.

* cited by examiner

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(57) ABSTRACT

In a method for forming an interconnection structure, first, second and third insulating films and a thin film are sequentially formed over lower-level metal interconnects. Then, the thin film is masked with a first resist pattern and etched to form a mask pattern with openings for interconnects. Next, the third insulating film is masked with a second resist pattern and dry-etched such that the third insulating film and the first and second resist patterns are etched at a high rate and that the second insulating film is etched at a low rate to form openings for contact holes in the third insulating film and remove the first and second resist patterns. Then, the second insulating film is masked with the third insulating film and dry-etched such that the second insulating film is etched at a high rate and that the first and third insulating films are etched at a low rate to form the openings for contact holes in the second insulating film. Then, the third and first insulating films are masked with the mask pattern and the second insulating film, respectively, and dry-etched such that the first and third insulating films are etched at a high rate and that the mask pattern and the second insulating film are etched at a low rate to form wiring grooves and contact holes in the third and first insulating films, respectively. Finally, upper-level metal interconnects and contacts are formed.

8 Claims, 37 Drawing Sheets

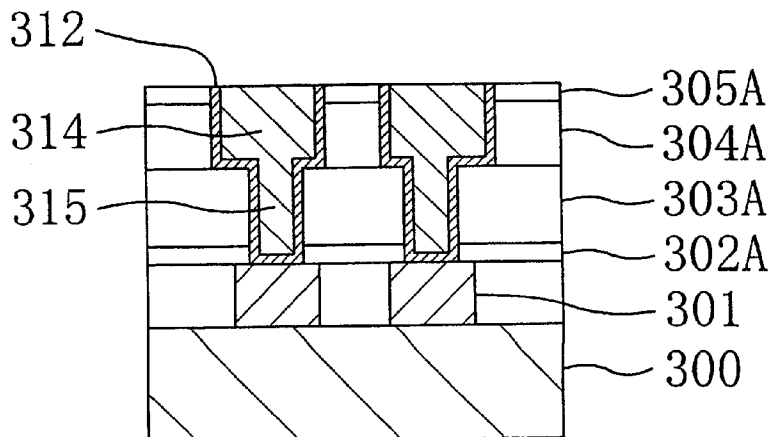


Fig. 1 (a)

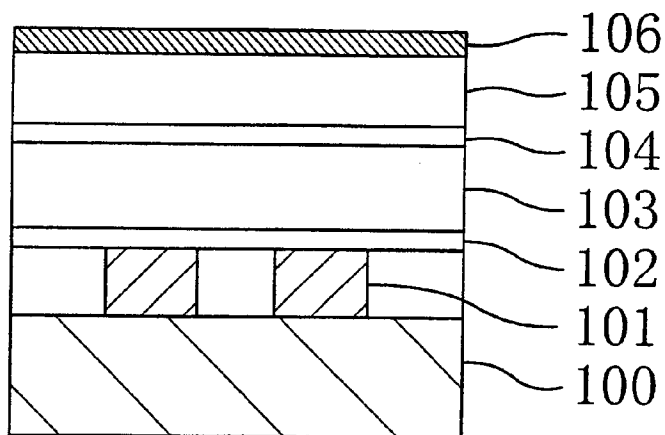


Fig. 1 (b)

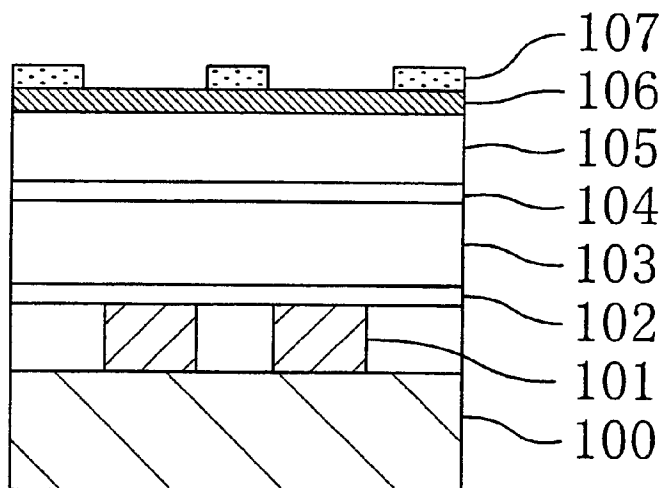


Fig. 1 (c)

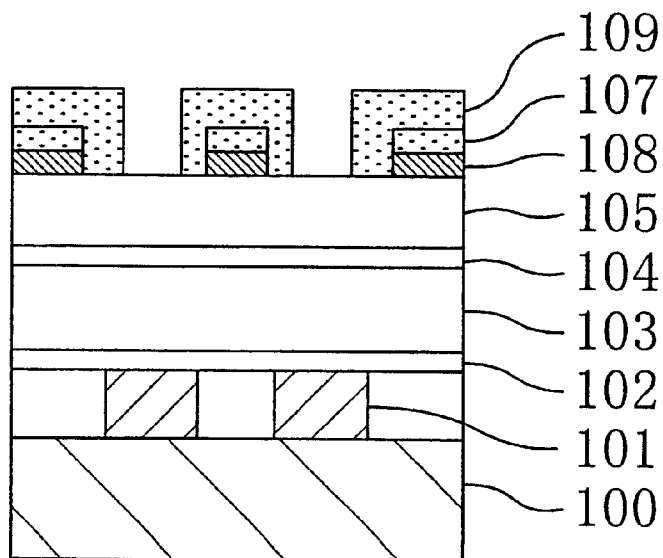


Fig. 2(a)

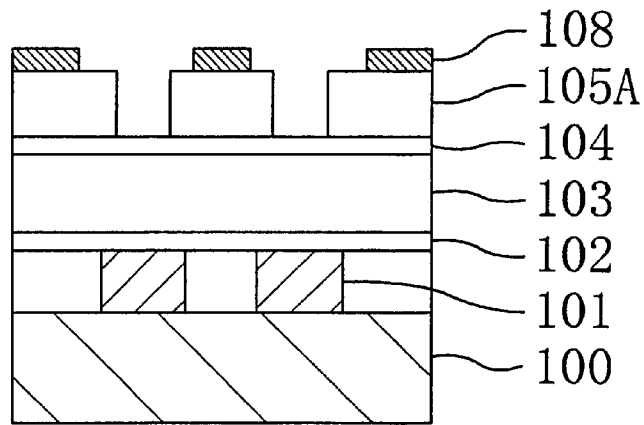


Fig. 2(b)

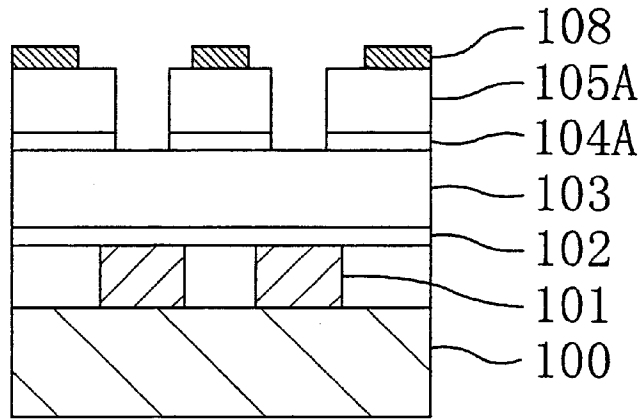


Fig. 2(c)

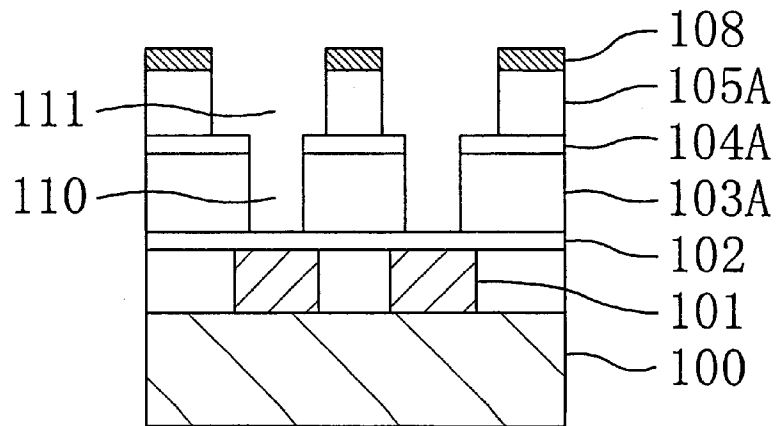


Fig. 3(a)

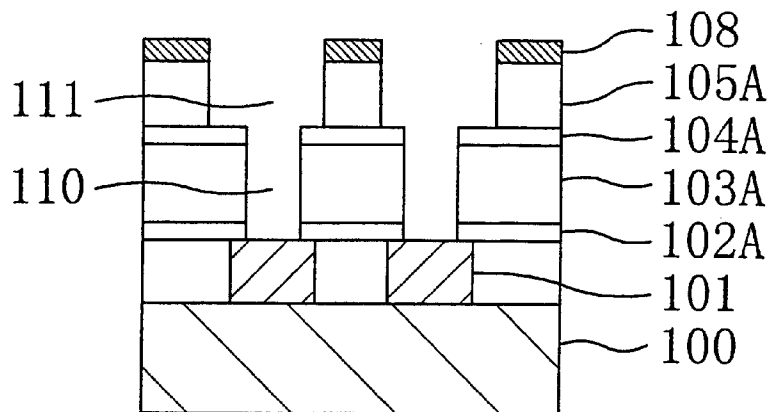


Fig. 3(b)

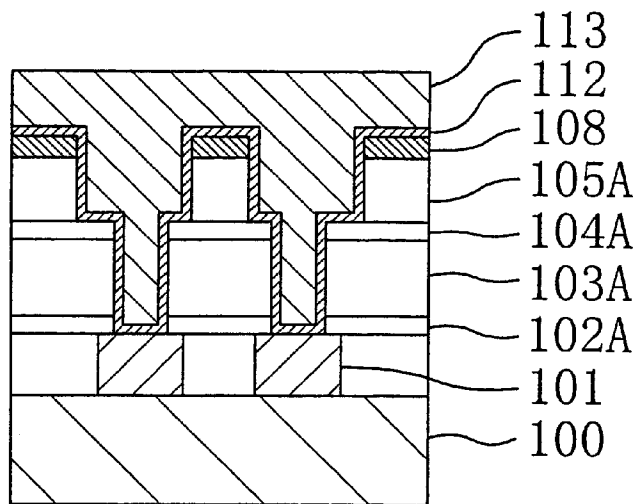


Fig. 3(c)

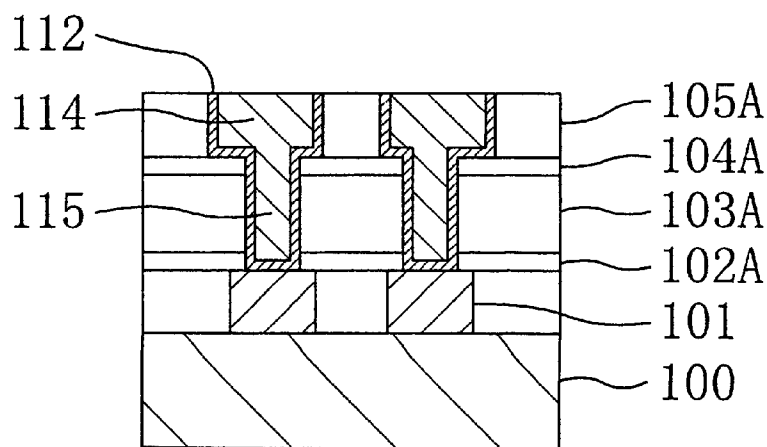


Fig. 4(a)

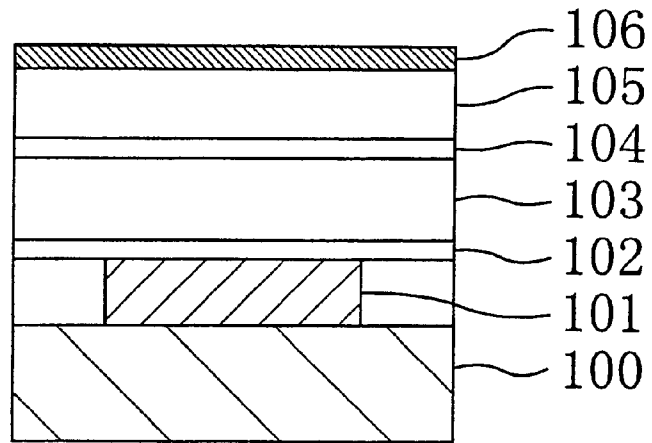


Fig. 4(b)

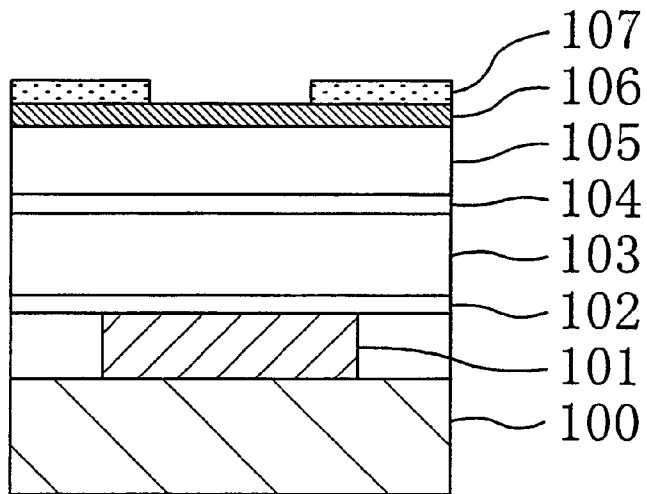
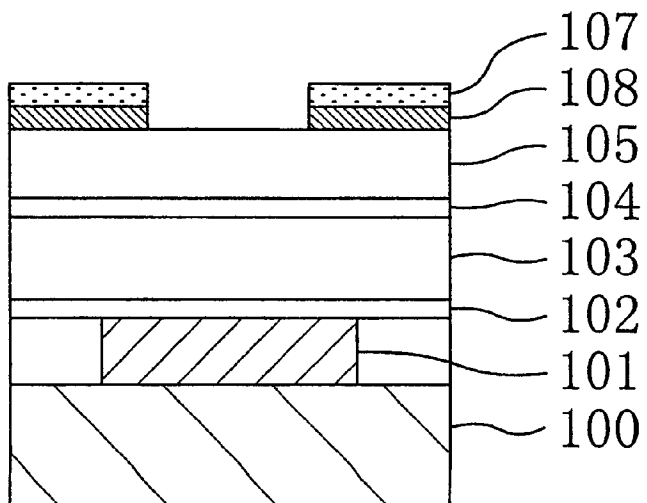


Fig. 4(c)



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