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10-0457159
2004 11 04

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(22) 2001 12 26

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(43)

10-2003-0055390
2003 07 04

(73)

136-1

(72)

49-1

102-1207

507-2

(74)

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(54)

가 (magnetic RAM, MRAM)

가 가

3

1
2 7 1 6

< >
11, 51, 91, 201, 301, 401, 501 :
13, 53, 93, 203, 303, 403, 503 :
15, 55, 95, 205, 305, 405, 505 : ,
17a/17b, 57a/57b, 97a/97b, 207a/207b, 307a/307b, 407a/407b, 507a/507b : /
19a, 59a, 99a, 209a, 309a, 409a, 509a :
19b, 59b, 99b, 209b, 309b, 409b, 509b : 1

21, 61, 101, 211, 311, 411, 511 : 1
 25, 65, 105, 215, 315, 515 : , 2
 27, 67, 107, 217, 317, 417, 517 : 2
 29, 519 :
 31, 71, 111, 221, 321, 421, 521 : 3
 33, 73, 113, 223, 323, 423, 523 : 2
 35, 75, 325, 525 :
 39 : 41 :
 43 :
 45, 85, 117, 227, 327, 427, 527 : 4
 47, 87, 127 : 49 : MTJ ,
 69a, 109, 219, 319a, 419 : 1
 69b, 143, 239, 319b, 447 : 2
 79a, 119, 229, 329a, 429, 529 : 1
 79b, 129, 251, 329b, 457, 539 : 2
 81a, 121, 231, 331a, 431, 531 :
 81b, 131, 253, 331b, 459, 541 :
 83a, 123, 233, 333a, 433, 533 : 1
 83b, 133, 255, 333b, 461, 543 : 2
 89a, 145, 340a, 470, 550 : 1MTJ
 89b, 147, 340b, 480, 560 : 2MTJ
 115, 225, 425 : 1
 125, 235, 335, 435, 535 : 5
 135, 439, 545 : 6 137, 441 : 3
 139, 245, 453 : 2 141, 445 : 7
 237, 337a, 437, 537 : 1 259, 337b, 465, 547 : 2
 415 : 1 , 2 443 : 2 , 3
 451 : 4 463 : 8

ash memory) , SRAM , DRAM 가 (fl
 (magnetic RAM, MRAM) .
 MRAM MRAM
 MRAM 가 ,
 MRAM (giant magnetoresis
 tive, GMR) (GMR) MRAM ,
 MRAM , GMR
 MRAM , 가
 , MRAM ,
 1 1 MRAM
 1 (11) (15), 1 (15)
 (31) (13)
 , (15) (11) / (17a, 17b) MOSFET
 , / (17a, 17b) (19a) 1 (19b) .
 (19a) 1 (19b)

(23) 1 (21) 1 (19b) 1
 , 1 (23) 2 (25) 2 (27) (29) 2
 , (29) 2 (31) 3 (31) (33) (33)
 , 3 (31) (25) 2 (35) 2 (35) 2 (33)
 , 2 (33) (35) (35) 2 (33)
 (27) (35) (free ferromagnetic)(43) (pinned ferromagnetic)(39), (tunnel
 barrier layer)(41) MTJ (magnetic tunnel junction) (49)
) (29) (39)
 , (43) '0' '1' (43) (39)
 , (43) 4 (45) (45) (45)
 (45) 1 MRAM (47) (45)
 , MRAM MTJ (49), 가 MTJ (15) 2
 (29), MTJ 가 가 MTJ (47)
 , MTJ (47) 가 , 1 (15) MTJ 가
 MTJ (29) (47) 가 , (off) , 2
 (47) (29) MRAM 가 MTJ (43)
 , MTJ , MRAM 가 MTJ 가 ,
 , MTJ 가 가 TMR (tunneling magnetoresi
 stance)
 , TMR
 , MTJ
 가
 MTJ , MTJ 가
 MTJ
 / , /
 , 1
 , 1
 2 1 2 1 1 1
 2 , 1 2 2 1 1
 / , /
 , 1 , 1 1
 , 1 1 1

1 2 , 1 2 1 2 , 1 2 1

2 2 2 1 2 / , /

2 1 2 1 1 2 1 2

3 1 2 1 2

1 1 1 1 1 1 1

2 2 2 2 2 2 2

2 1 4 2 2 2 2

(magneto- resistance device)

10⁵ 10⁶ 가 MRAM

MRAM

II-V , MTJ, AMR, GMR, (spin valve), / , I

()/ , CMR (Colossal Magneto-Resistance),

2 7 1 6 MTJ

2 3 1 2 , MTJ

2 (57a, 57b) , / (57a, 57b) (51) / (53)

(55) (75) , (75) (57a) (59a) , (59b)

(75) 1 MTJ (89a) (75) 1 MTJ (89a) 2 MTJ (89b) , 1 MTJ (89a) 2

MTJ (89b) (75) 1 (69a) 2 (69b) , 1 MTJ (

89a) 2 MTJ (89b) (87) MTJ (69a, 69b)

MTJ 가

MTJ 3 2 가 가

3 MTJ (91) , (91) / (93)

(97a, 97b) , / (97a, 97b) (97a) (99a) , (99b)

(95) (115) , 1 (115) 1 MTJ (145) , 1 (115)

(145) 1 (109) , 1 MTJ (145) (127) , (127) 1 MTJ (115)

2 (139) , 2 (139) 2 MTJ (147) , 2 MTJ (147)

4 5 (139) 3 4 2 (143) MTJ

(writing) MTJ 가

MTJ 3 MTJ

2 가

4 (207a, 207b) , / (201) , (201) / (203)
 (205) , / (207a, 207b) (207a) (209a) , (209b)
 1 (225) , 1 (225) 1 MTJ (270) , 1 (225)
 1 (225) (219) , 1 MTJ (270) 1 (237) , 1 (237)
 (239) , 2 (239) 2 (245) , 2 (245) 2 MTJ (280) , 2 MTJ (280)
 2 (259) .

5 (307a, 307b) , / (301) , (301) / (303)
) (305) (307a, 307b) (307a) (309a) , (309b)
 (325) , (325) 1 MTJ (340a) , (307b)
 가 (325) 1 MTJ (340a) (325) 2 MTJ (340b) ,
 1 MTJ (340a) 2 MTJ (340b) (325) 1 (319a) 2
 (319b) , 1 MTJ (340a) 2 MTJ (340b) 1 (337a) 2 (337
 b)

6 5 (401) , (401) / (407a, 407b)
 , / (407a, 407b) (403) (405)
 (407a) (409a) , (409b) 1
 (425) , 1 (425) 1 MTJ (470) , 1 (425)
 1 (419) , 1 MTJ (470) 1 (437) ,
 1 (437) 2 (453) , 2 (453) 2
 (447) , 2 (447) 2 (453) 2 MTJ (480) , 2 MTJ (480)
) 2 (465) .

6 MRAM , (writing) MTJ (419, 447)
 . 7 6

07b) , / (501) , (501) / (507a, 5
 5) (507a, 507b) (503) (50
 5) (507a) (509a) , (509b)
 1 (525) , 1 (525) 1 MTJ (550) , 1 (525)
 1 (519) , 1 MTJ (550) 1 (537) , 1 (537) 1 M
 TJ (550) 2 MTJ (560) , 2 MTJ (560) 2 (547) .
 , III-V , MTJ (221) AMR, GMR, (spin valve) , / .
 , CMR (Colossal Magneto-Resistance) ,

(magnetic hard disk head) (magnetic sensor)

MRAM (MOSFET) /

MRAM

가

(57)

- 1.
- 2.
- 3.
- 4.

/ ;
/ ;
1 ;
1

2 ;
1 2 ; 1
2 1 2 ;
1 2

5.
4

가

6.
5

MTJ, AMR, GMR, (spin valve), / , III-V
/ , / CMR 가 가

7.

8.

9.

10.

/ ;
/ ;
1 ;
1 1 ;
1 1 ;
1 1 ;
1 1 ;
2 1 ;
2 2 ;
2 2 ;
2 2 ;
2 2 ;

11.
10

가

12.
11

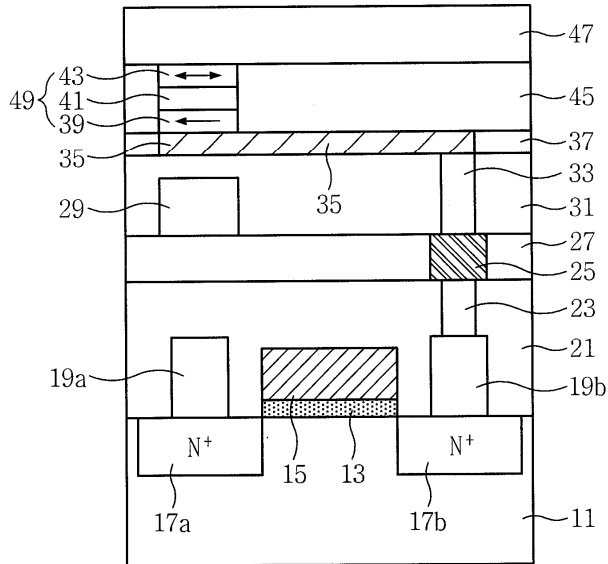
MTJ, AMR, GMR, (spin valve), / , III-V
/ , / CMR 가 가

13.

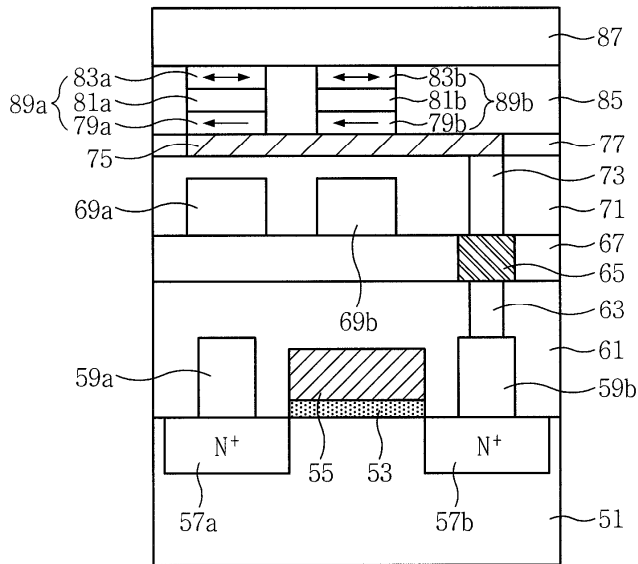
/ ;
/ ;
1 ;
1 ;
2 ;
1 2 ; 1
2 1 2 ;
1 2 ;
1 2 ;
1 2 ;

- 13 **14.** , 가 .
- 14 **15.** , MTJ, AMR, GMR, (spin valve), / CMR , III-V 가 가 .
- 1 **16.** / ; ;
1 ;
1 1 ;
1 1 1 ;
1 2 ;
2 2 ;
2 2 1 ;
2 ;
2 2 .
- 16 **17.** , 가 .
- 17 **18.** , MTJ, AMR, GMR, (spin valve), / CMR , III-V 가 가 .
- 19.**
- 20.**
- 21.**

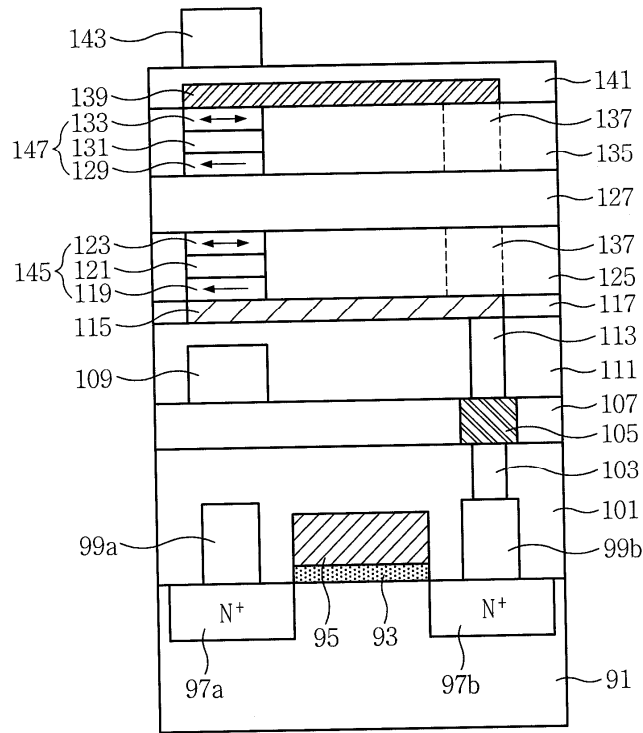
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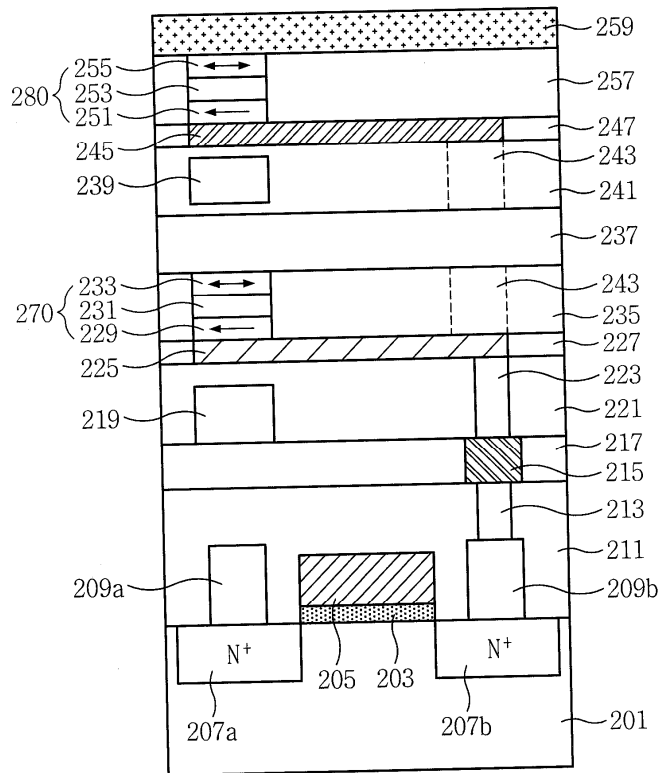
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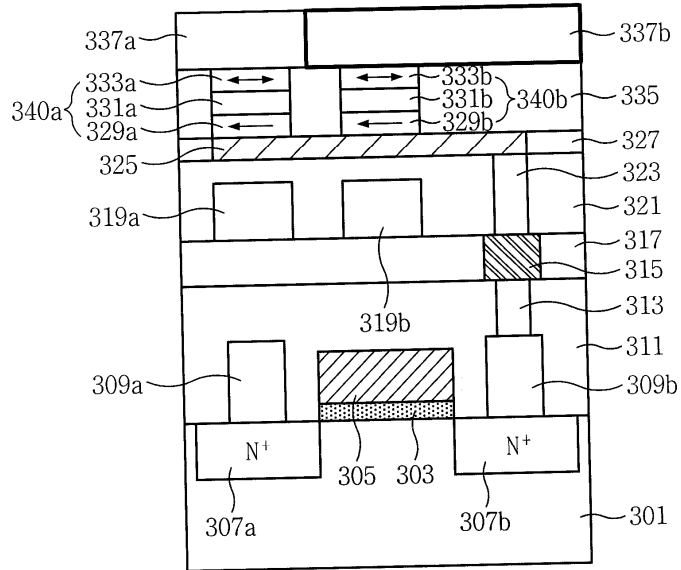
3



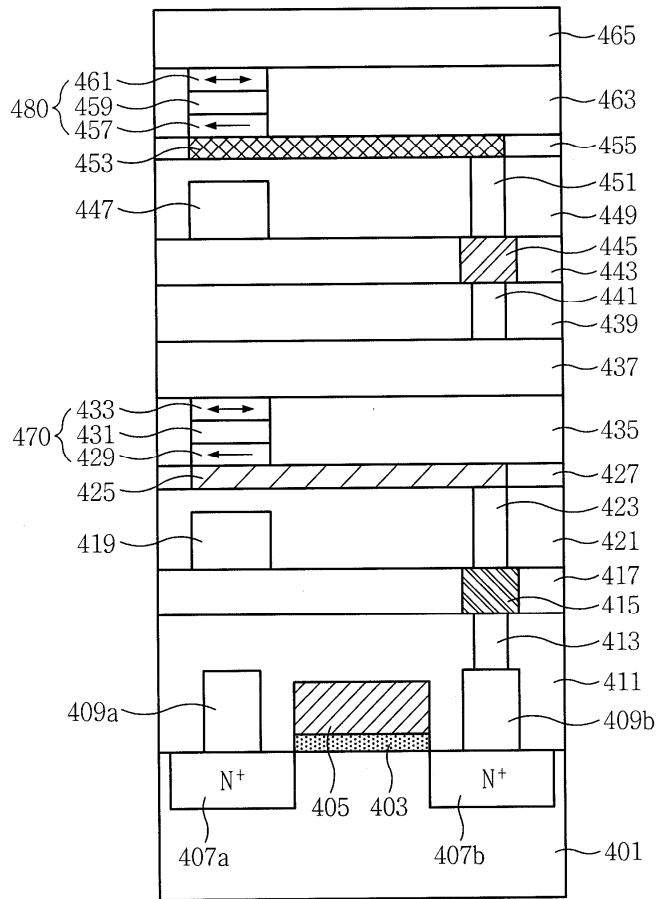
4



5



6



7

