

	(19) (12)	(KR) (A)	(11) (43)	10- 2010- 0039291 2010 04 15
(51)	Int. Cl.		(71)	
	<i>HDIL 21/322</i> (2006 01)			
(21)	10- 2009- 7027309			(: 63376- 5000)
(22)	() 2008 06 26			8 501
			(72)	
(85)	2009 12 29			
(86)	PCT/US2008/068284			63376- 5000
(87)	W0 2009/006182			501
	2009 01 08			
(30)	11/771, 667 2007 06 29 (US)			63376- 5000
				501
			()	
			(74)	
	: 26			
(54)				
(57)				

N

(72)

,	,
63376- 5000	63376- 5000
501	501
,	,
.	.
,	,
63376- 5000	63376- 5000
501	501
,	,
.	.

1

(pre-existing) (dissolve) 1150
 (ingot) (slice) , ,
 5m *cm -;
 , N
 N (dopant) , 10m *cm
 -;
 (vacancy)
 (i) (atmosphere) (ii) ,

2

1 ,

, .

3

2 ,

, .

4

3 ,

1000 ppm

, .

5

2 ,

20 / , .

6

2 ,

5 / , .

7

1 ,

,

20 /

,
 , .

8

1 ,

,

9

2

950

1150

20 /

2

10

9

950

2

11

1

N

12

11

P, As

13

1

P-

14

13

B, Al, Ga

15

1

N

5cm

16

1

17

(oxygen precipitate nuclei)

, 5m *cm

		N	-	N
	10m *cm			
18				
17		N		
19				
18		P, As		
20				
17		P		
21				
20		B, Al, Ca		
22				
17				
N	5cm			
23				
17				
	100 m · cm	100 · cm		
24				
17				
			15 (oxygen interstitial atoms)	
25				
24		50%		
26				
24		10%		

[0001]

(N⁺) P⁻ (P⁺) N⁻ (N)

[0002]

(Czochralski process) (seed crystal) (molten silicon)
(immersed),

[0003]

nucleation center) (cluster) (oxygen precipitate)
(gettering)

[0004]

5,994,761 (thermal annealer) Falster
(vacancy) Falster
6,336,968

[0005]

(self interstitial)
N ()
(avalanche breakdown voltage)

[0006]

[0007]

5m *cm 100m *cm
N

[0008]

[0009]

N () , N / N⁺ N⁻
/P⁺

(4 800 16 1000)

[0010] I.

[0011] (Czochralski crystal growing method)

(ingot)

(lapping)

(self-interstitial point defect)

(predominant intrinsic point defect)

[0012] 5×10^{17} 9×10^{17} (ASTM

F-121-83).

[0013] (1410) 750 350

(cooling rate)

(

)

(rapid thermal

annealing heat-treatment)

(dissolve)

[0014] N P N

P

5m · cm

3m · cm

N+

P+

2m · cm

1m · cm

[0015] 1. $24 \times 10^{19} \text{ at/cm}^3$ N

2. $25 \times 10^{19} \text{ at/cm}^3$

N

3. $43 \times 10^{19} \text{ at/cm}^3$

7. $36 \times 10^{19} \text{ at/cm}^3$

N

2. $1 \times 10^{19} \text{ at/cm}^3$

P-

3. $7 \times 10^{19} \text{ at/cm}^3$

P-

5. $7 \times$

10^{19} at/cm^3

1. $2 \times 10^{20} \text{ at/cm}^3$

P

[0016] II.

[0017] (ISF;

Oxidation Induced Stacking Faults)

(RTA: Rapid Thermal Annealer)

1175 , 1200 , 1150 , 1200 1275 ,
 (3) , (20 30 40 50 10
 60)

[0018]

RTA (RTA ; Rapid Thermal Annealing furnace)
 RTA , RTA RTA
 , 1200 ,
 RTA Mittson Technology() 3000 RIP

[0019]

III. (profile)

[0020]

CSF ,
 (number density) ,
 CSF
 (nucleated oxygen agglomerates) ,
 (oxygen
 clustering)
 ,
 ,
 ,
 ,
 ()

[0021]

A (cooling atmosphere)

[0022]

,
 ,
 ,
 ,
 (frankel pair recombination)
 ,
 ,

[0023]

,
 (Q),
 ,
 ,
 0.001 (atm) 1000(ppma; parts per million atomic)
 0.002 atm (2,000 ppma),
 0.005 atm (5,000ppma), 0.01 atm (10,000 ppma)

[0024]

B

[0025]

(-)
 , ()
 (diffusivity) ,
 , 700

700 , 800 , 900 1,000

[0026]

,

[0027]

(950) 20 / , 10 /
5 /
, 950 1150 (2 3 4 6
(2 3 4 6)

[0028]

[0029]

(nitriding atmosphere; (N)
() , (, , ,
)

[0030]

IV.

[0031]

(out-diffusion) , ,
15 , 10
5
3
50%
20% , 10%

[0032]

V.

[0033]

5cm
(chemical vapor deposition) ,
5, 789, 309
10m · cm (100m · cm) N
100m · cm 100 · cm
300m · cm 10 · cm

[0034]

N , 4.8×10^{18} at/cm
4.3 × 10¹³ at/cm 7.8 × 10¹⁶ at/cm , N
4.4 × 10¹⁴ at/cm 1.9 × 10¹⁶ at/cm

[0035]

, N
N ,

[0036]

(feed) , N
(carrier gas)

[0037]

VI.

[0038]

0.001 (atm) 1000ppma
0.002 atm (2,000 ppma), 0.005
atm (5,000 ppma), 0.01 atm (10,000 ppma)

[0039]

(950)
20 / , 10 / , 5 /
950 1150 (20 /
) , 1150
2 3 4 6 , 950 2 3 4 6

[0040]

VI.

[0041]

(grain boundary)
5,310,698 , 5,792,700
(Si H)

[0042]

(thristor) MOSFET JFET

[0043]

, " (said)", " (the)", " (a, an)"
" , " "
"N⁺" "P⁺"
"N⁺⁺", "N⁺⁺⁺" "P⁺⁺", "P⁺⁺⁺"

[0044]

[0045]