

(19) (12) (KR) (A)

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2004 11 03
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(30) 10/139,067 2002 05 03 (US)
(71) / - , . 01854, , 1011
(72) , , 02071, , 1865
, , 01879, , 18
, , 01801, , 3 5
(74) :

(54) P - I - N

1 1 1 , 2 2 ,
1 2 P-I-N .
1 2 . 1 2
,
P-I-N I- P-I-N 가
.

2
,
,

P-I-N (military) (element) .
 (passive radiation imaging systems) (automotive collision avoidance systems :CAS),
 (radar) (,)
 가 RF
 P-I-N (Si) (GaAs) P-I-N (discrete)
 1 가 (MHz) 100 가 (GHz) .
 P-I-N (insertion loss) (isolation)
 (series-measured) 가 ' (on)' ,
 measured) 가 ' (off)' (series-
 .(가 (shunt configuration) 가 .) P-I-N
 , P-I-N - (single-pole multi-throw: SPMT)
 , - (single-pole double-throw: SPDT) - (mono
 lithic integrated single-pole single-throw: SPST) , (I-)
 가 ,
 (BJTs), HEMTs FET
 (terminal) N-P-N
 3 (three terminals) , 가 가 ,
 가 가 ,
 가 가 ,
 N 가 ,
 가 . P-I-
 , P-I-N 1 1 , 2
 2 , 1 2
 1 2 . 1 2
 (composition)
 (homojunction) P-I-N P-I-N I
 (relative to) ,
 , (semi-insulating) , 1
 1 (cathode) , 1
 , 2 2
 (anode) , 1 2
 가 .
 가 .

1a 1b

P-I-N

2	P-I-N		
3A	1	P-I-N	
3B	2	P-I-N	
3C	3	P-I-N	
4	P-I-N		
5	P+AlGaAs	P-I-N	
6	P-I-N		(rate)
7	P-I-N		
8	P-I-N		(plot)
9	P-I-N		
(plot)			
10		P-I-N	
11	20%	P-I-N	SIMS(Seconda
ry Ion Mass Spectrometry)			
12A		P-I-N	
12B	P-I-N		
12C	P-I-N		
1A	1B	P-I-N	
	(130)	P-I-N	(100) N+
(two terminals)	I _f 가	(120) w	1A
			가
			(110) P+
			(DC to f _t) 2
			(e) (h)
			I=I _o (e
q(Va-IRs/nkT) -1)	P-I-N		RF
1B	(transition)	f _t 가 f _t =?? _p kT/qW ²	(f _o >f
t)	w	DC	1/f _t
	R _i	R _i =W ² /2?? _{ap} I _f ??	RF
	P-I-N	I _f	Q _t =(?? _n I _f + ?? _p I _f)
			Q _t 가
			가
			(R
2	, 2	가	
(GaAs) P-I-N	(200)	GaAs	-

N+ GaAs (40) . GaAs (I) (30) N+ GaAs (40)
 GaAs P+ (20) I- (42) N+ GaAs (40) (ohmic) (22) GaAs P+ (20)
 N- (42) N+ GaAs (40)

3A (300) , 가 (300) P-I-N 2 -
 (50) , N+ GaAs (300) , GaAs -
 (42) , N+ (40) N-
 (??m) 가 GaAs 5X10¹⁸ cm⁻³ (heavily) 2
 (establish) (40) 20??m (unintentionally)
 GaAs (30) 0.8??m P+ (AlGaAs)
 (20')가 (30) . AlGaAs P+ 5X10¹⁹ cm⁻³
 5% 20% . p- (22) (20') Al . (,

3A , 4mils 8mils ,
 (backside) N+ , 4mils
 8mils ,

3A , AlGaAs (20') I P+
 가 . (가 (conduction band) 가 (v
 alance band)) 가 P+ I
 3A P-I-N , I (back injection) .
 , P-I-N , I 가
 () (, f_o > f_t)
 가 , I (20', 30,
 20' 30 가) P-I-N
 P-I-N I RF P-I
 -N .

P-I-N 가
 DC (application) (many orders of
 magnitude) I 가 , 가
 (open) 가 , 가 (turn on) ,

3B 2 P-I-N (300') .
 (30) (40') 3A (40) AlGaAs
 N+ (40) 1 P+ AlGaAs (20') 가 N+ AlGa
 As (40') 3B 3A 2
 , AlGaAs P+ (20') 0.8 N+ (40') 2 5%
 5% (30) 2

3C (40') (50) N+ AlGaAs P-I-N(300??)
 (30) (30) 0.8 GaAs I-
 GaAs P+ (20) I- (30)
 (30) N+ AlGaAs (40')
 가 (40') 5% Al . (30) N+ (40')

4-10 3A-3C P-I-N

4-9 10 P-I-N
 4 P+ (20')(3A, 3B) (Al) P+ - I
 10mA 5%, 10% 20% Al
 P+ AlGaAs (IV) 410, 420,
 430 (440) GaAs () IV
 4 10mA 5% AlGaAs (DC)
 (slope) 가 5 AlGaAs (510) GaAs
 (520) 100meV 20meV 가
 (??E_C ??E_V) 5 10
 mA P-I-N P+
 I (rate)
 6 3 P-I-N P, I, N
 P+ AlGaAs (600B) 6 , P+ GaAs-I (600A)
 (sizable). P+ 가
 P+ I
 7 P-I-N 3
 710 P+ AlGaAs , 7
 30 740 10mA R_I = W² / qA(
 u_p h⁺ + u_n e⁻) , u_p u_n
 P-I-N , (e⁻ + h⁺) 2.2 E16 ,
 GaAs 1.4E16 I 가 57% 가
 8 10mA (projected) P-I-N
 8 (3B) 810 P+I- I- /N+ P-I-N
 RF GaAs P-I-N 820
 가 830 가 3C P-I-N
 840 P+AlGaAs-I-N P-I-N
 9 2 3 P-I-N (insensitivity)
 (900) P-I-N 가 (penalty)
 가
 12A 1202, 1204, 1206, 1208, 1210 1212, 1214, 1
 216, 1218 1220 P-I-N (1200)
 1200
 (throw) (1209)
 (bond pads)(1213) (1211) (backsides)
 (connectivity) 12B 1212a, 1212b 1212c, (e
 ncapsulation) (1212d) (1212e) 12P
 -I-N 12C 1202
 a, 1202b 1202c
 10 Al P-I-N
 As 1010 10mA (on state)' 5% AlGa
 As P-I-N (GHz) (dB) 1020 10% AlGa
 , 1030 20% AlGaAs P-I-N
 1040 10mA GaAs P-I-N
 P-I-N 1010, 1020, 1030 10GHz 3d
 B

P-MOVPE) , P-I-N (L
 . GaAs AlGaAs 25:1 AsH₃ / (TMGa+TMA1) , GaAs - 0.
 08 . 30cm/sec 6 76Torr (liters)
 3- (uniformities) +/- 2% , +/
 - 3% . AlGaAs (photoluminescence) +/- 2% .
 P-I-N P+ -I-N GaAs N+ AlGaAs (incorporation)
 , P-I-N P (minor) 가 , ((precursor)
 (species) AlGaAs (challenge)가
 (compensation) 가 , AlGaAs , AlGaAs
 (700±C) (passivation) 가
 , 600 가
 가 , AlGaAs P+ GaAs (I) P-I-N
 . GaAs N+ AlGaAs P+ GaAs N+ 650
 가 C-V (net) - (Van der Pauw-Hall)
 P-I-N 가
 P-I-N -
 5E18(cm⁻³) 2??m N+ (bottom)
 2??m ()
 1 N+ (stack) 5E19(cm⁻³)
 0.7??m-0.8??m P+ AlGaAs
 y:SIMS) P+Al_{0.2}Ga_{0.8}As P-I-N 2 (Spectrometr
 11 , AlGaAs , GaAs 1E19 (C)
 SIMS 가
 , P + 7% 300K

가

가

, AlGaAs tm P-I-N III-V ,
 (InGaP), (InP) III-V III-V
 (modifier) (Si), (Ge), P-I-N III-V IV
 II-VI, (C), SiGe, SiC, SiGeC , P
 -IV I- , P I
 가

(57)

1.

1

1 ,

2

1 2

1 2

P-I-N

2.

1 1 1

3.

1 1 2

4.

1 1 AlGaAs GaAs

5.

4 1 p- 2 n-

6.

5 1 0.8 2 2

7.

5 1 가 5%

8.

1 2 2

9.

8 1 2 AlGaAs GaAs

10.

1 (AlGaAs) 1

2 2

1 2 (GaAs)

P-I-N

11.

10 1 2

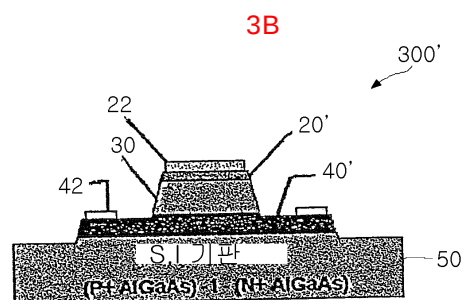
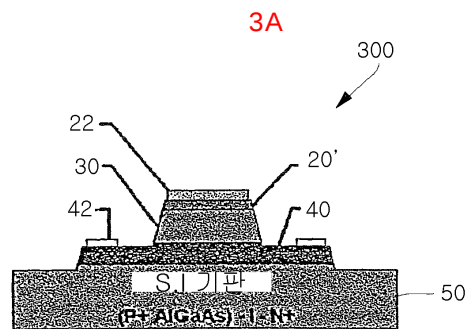
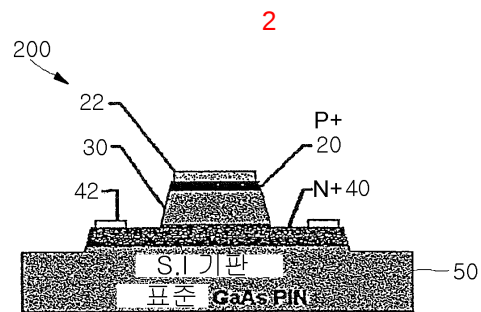
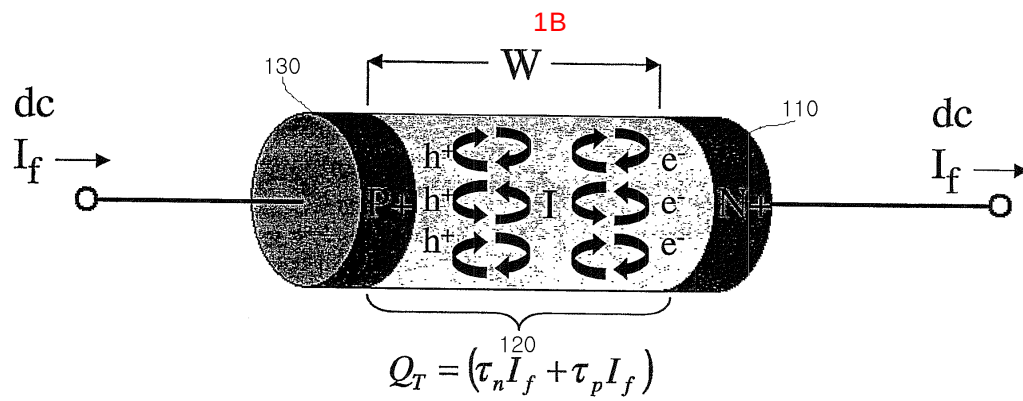
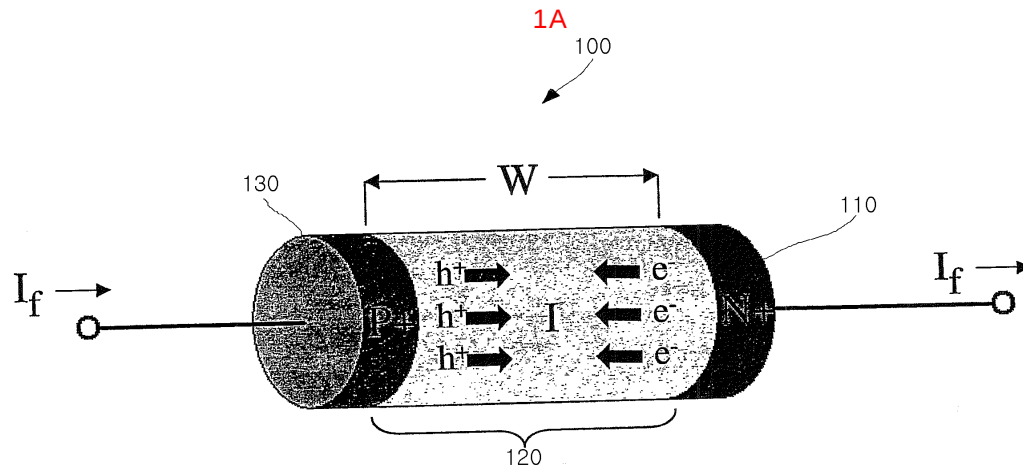
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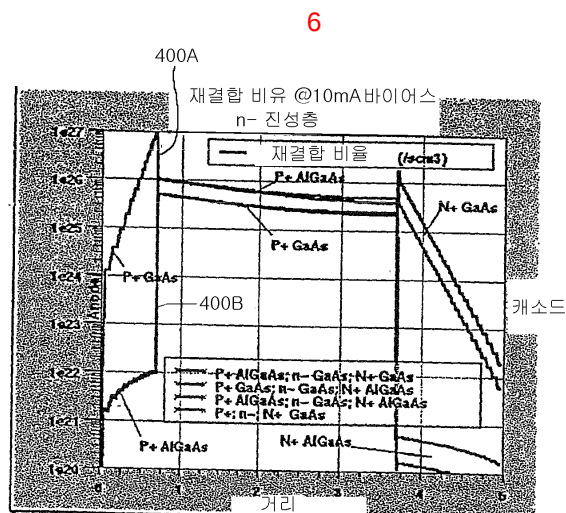
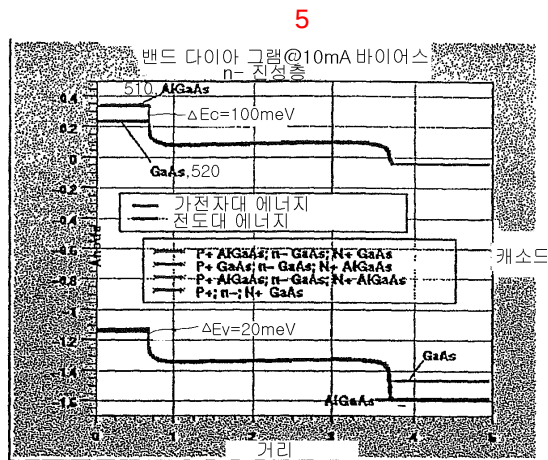
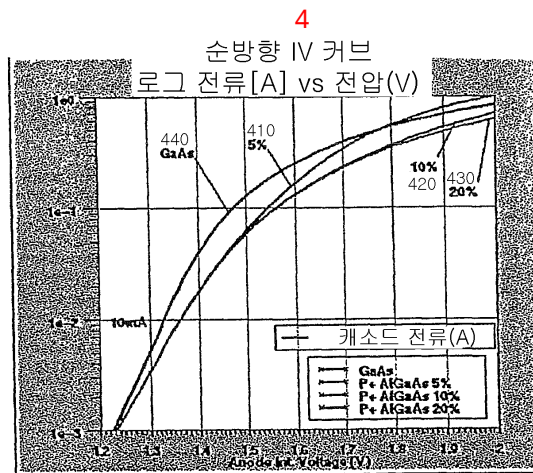
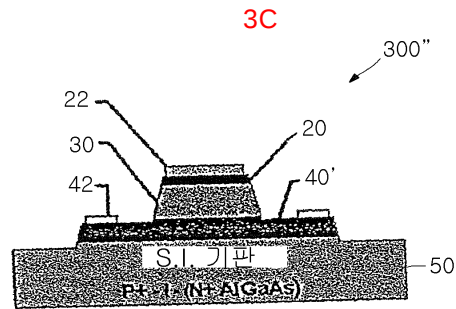
10 2 GaAs

13.

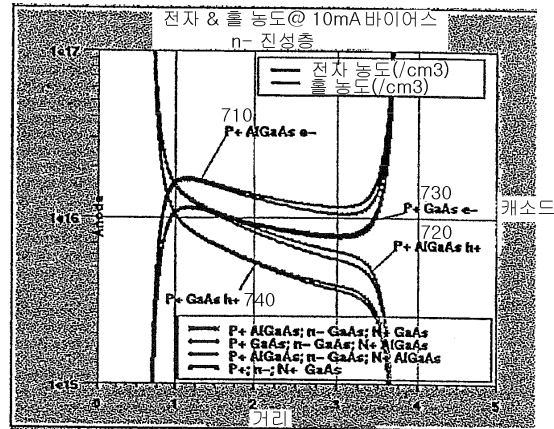
12 GaAs 2 n- GaAs 2 AlGaAs 1 p- GaAs

14. 13 , 1 5% .
15. 12 aAs , GaAs 2 AlGaAs p- 1 AlGaAs 1 n- 1 G .
16. 15 , 1 5% .
17. 10 , 2 AlGaAs .
18. 17 s 2 GaAs , AlGaAs 2 n- AlGaAs 2 AlGaAs 1 p- ALGaA .
19. 18 , 1 2 5% .
20. - (semi-insulating) ,
1 1 ,
1 ,
2 2
1 2
P-I-N .
21. 20 , 1 , 2 .
22. 21 , 600 700°C .
23. 21 , 650°C .
24. 21 , n- GaAs 1 .
25. 21 , p- AlGaAs 2 .
26. 21 , 1 2 .

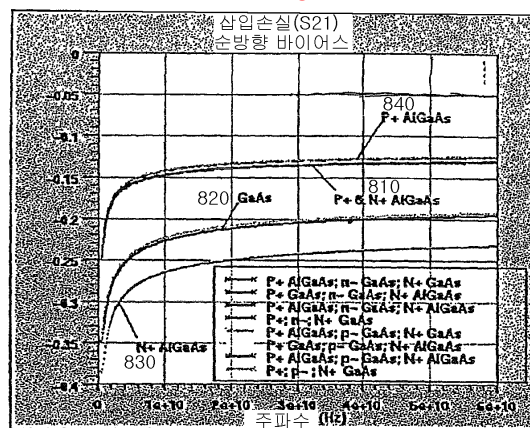




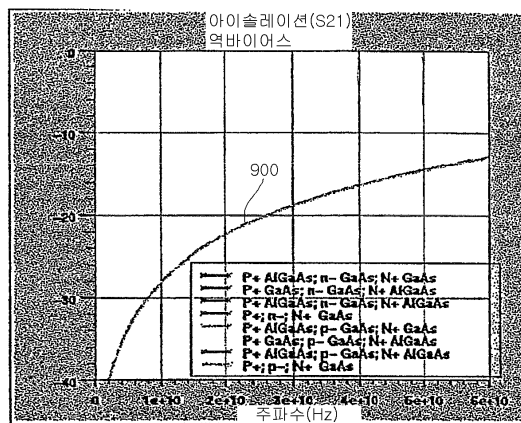
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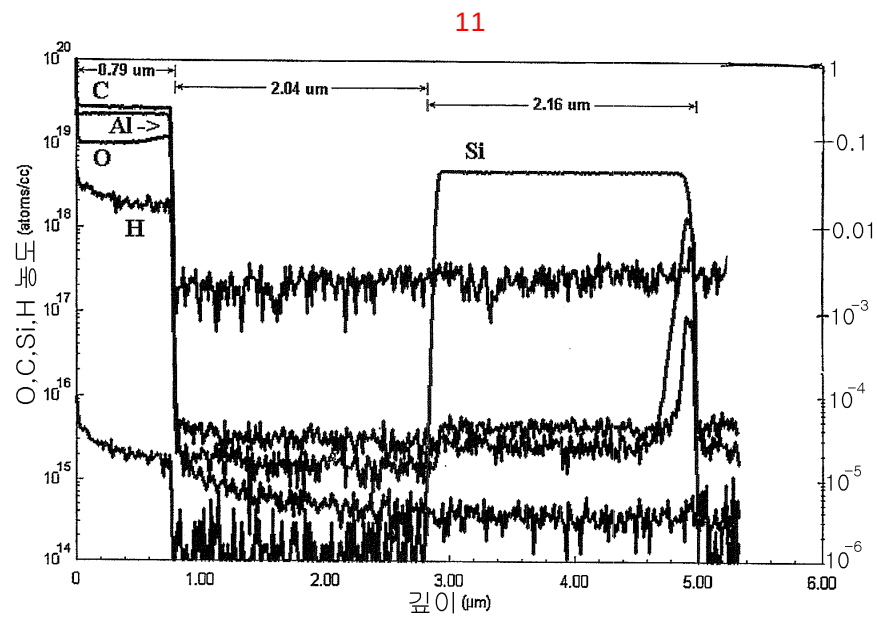
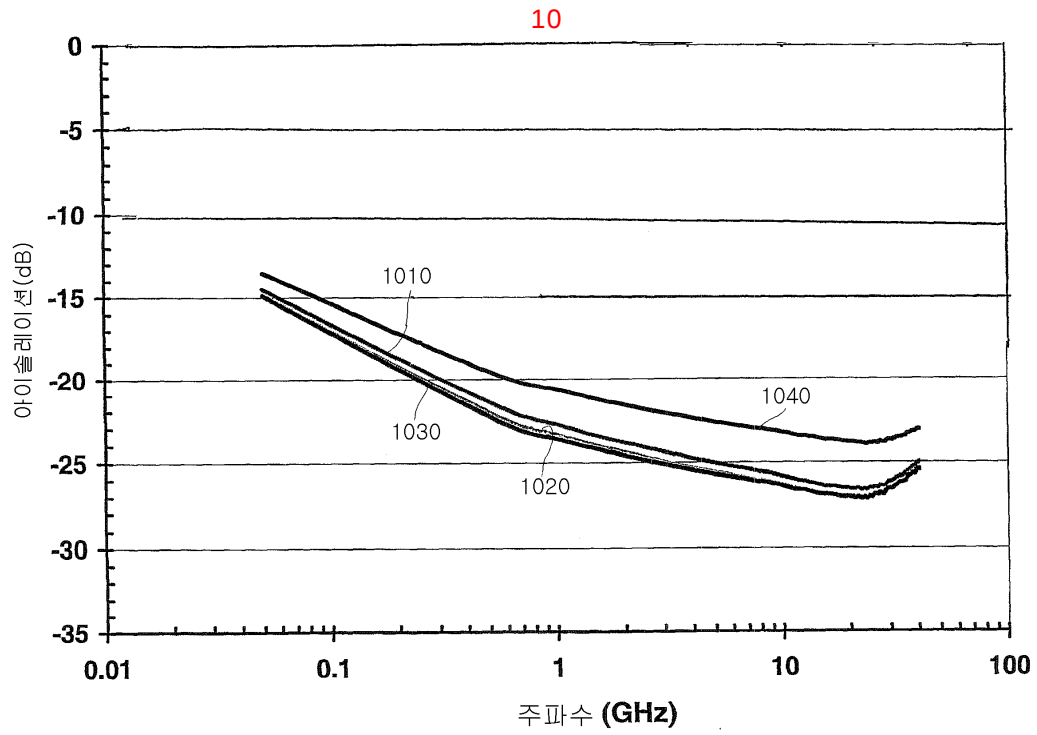


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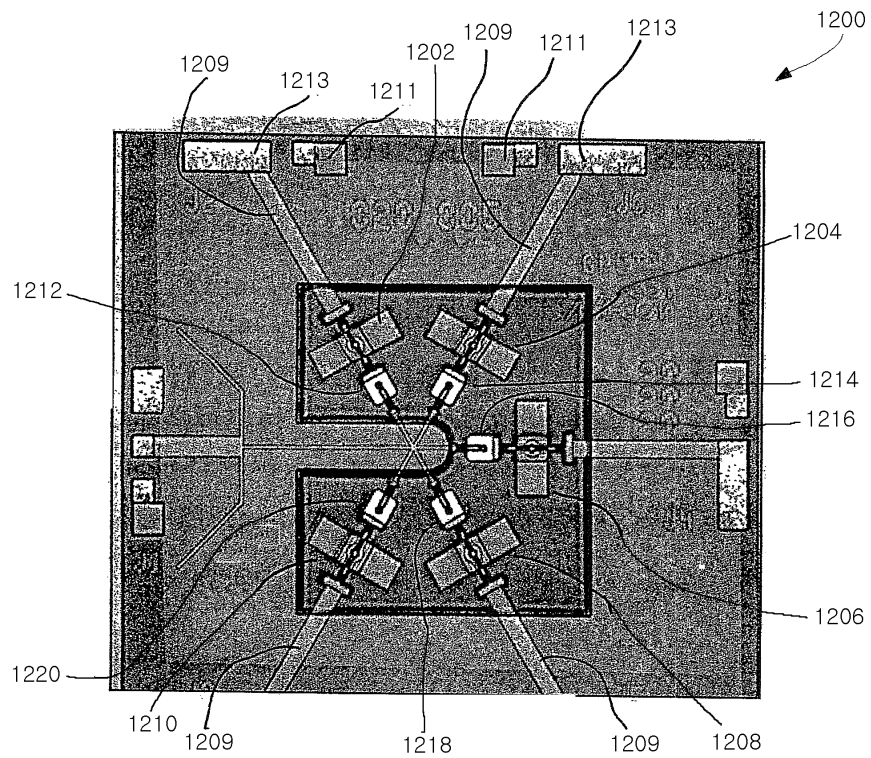


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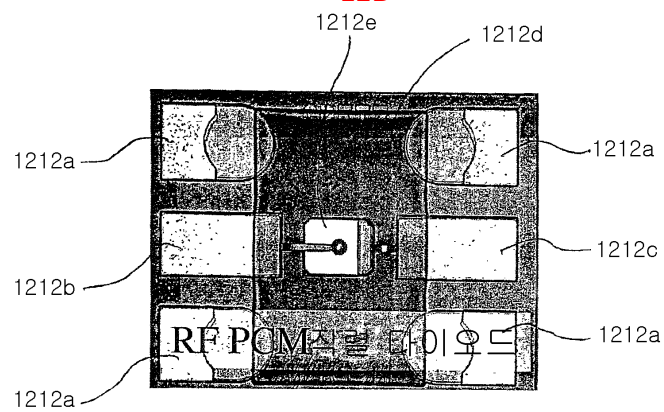




12A



12B



12C

