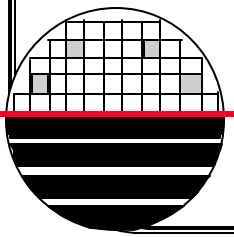
ROCHESTER INSTITUTE OF TECHNOLOGY
MICROELECTRONIC ENGINEERING

Pictures of John Galt Chip at Each Step in the Submicron CMOS Process

Dr. Lynn Fuller
Jessica Marks, David Caberra, Ellen Sedlack
Webpage: http://people.rit.edu/lffeee
Microelectronic Engineering
Rochester Institute of Technology
82 Lomb Memorial Drive
Rochester, NY 14623-5604
Tel (585) 475-2035
Email: Lynn.Fuller@rit.edu
Program webpage: http://www.microe.rit.edu



INSTRUCTIONS FOR TAKING PICTURES

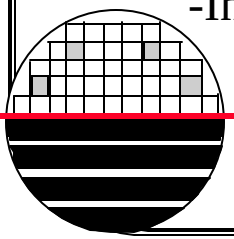
-Process step photos **needed** (topography changes)
- **-PH03 OX--, ET--, CV--, ME01**

-Process step photos **not needed** (topography does not change)
- **-Steps 1-5, CL01, IM01, DE01, SI01, etc.**

-Use **Leica Microscope** attached to PC in **Lithography Bay 1**
- **-Magnification**
  - -2.5X for Steps 6-18 - Wells and well implant steps
  - -10X + for Steps 19-End
- **-Viewing Area**
  - **-3 Images for Steps 6-18**
    - -Small NMOS/PMOS , Big NMOS/PMOS , Ring Oscillator
  - **-Steps19-End will need many images** to show small features

-Use **Osprey Software** to capture image
- **-Center** desired area in image viewer
- **-Ctrl+P** to take snapshot

-Use **Microsoft Power Point** to document images
- -Do not alter contrast/brightness/etc
- -Label image with what it is and magnification used
- -Insert process purpose in first slide for each step

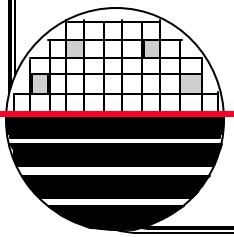


SUB-CMOS 150 PROCESS

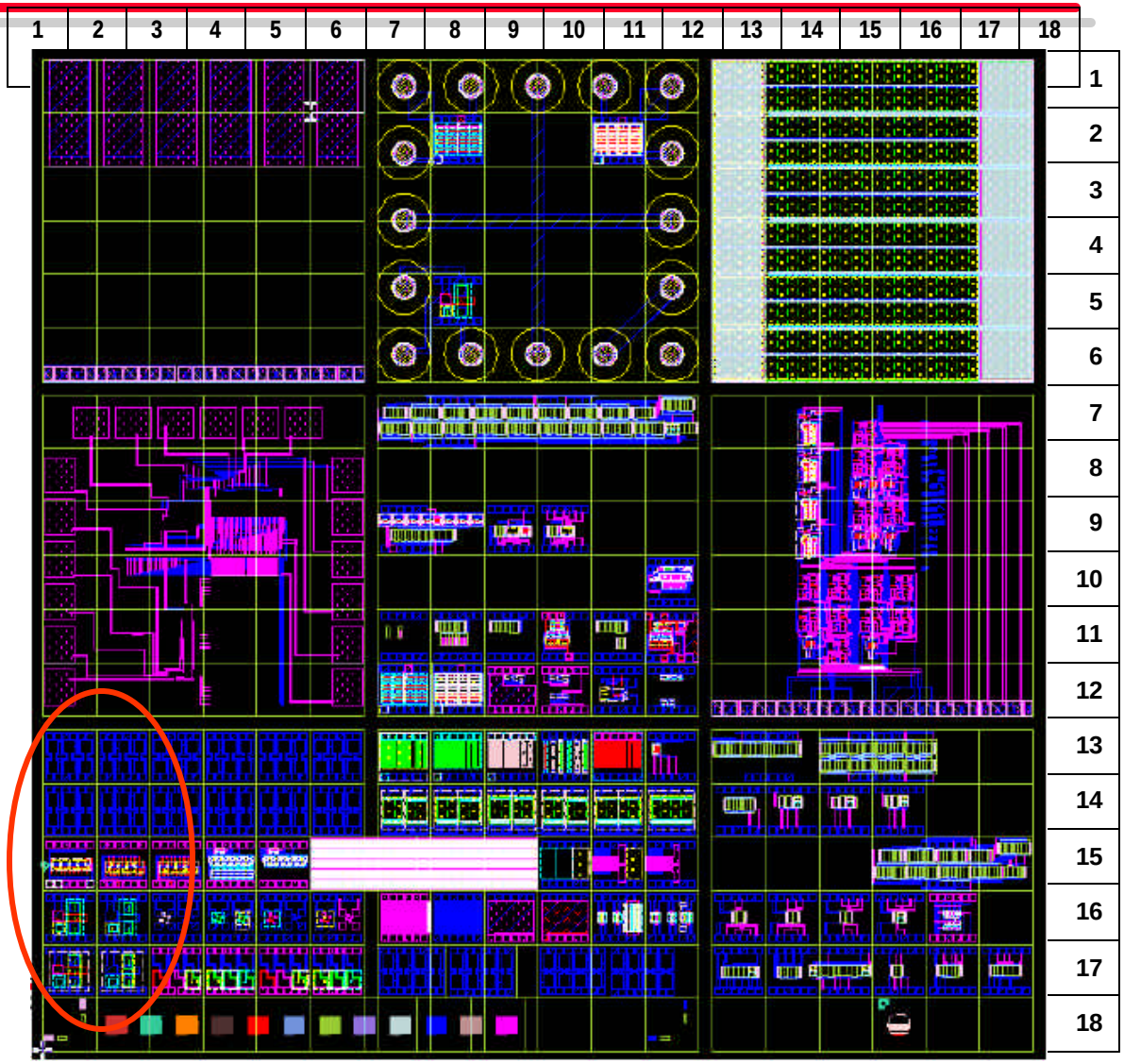
SUB-CMOS Versions 150

1. ID01 -scribe
2. DE01 – 4pt probe
3. CL01 – RCA Clean
4. OX05--- pad oxide, Tube 4
5. CV02- 1500 Å
6. PH03 –1- n well
7. ET29 – LAM490
8. IM01 – n-well P31
9. ET07 – Branson Asher
10. CL01 – RCA Clean
11. OX04 – well oxide, Tube 1
12. ET19 – Hot Phos
13. IM01 – p-well B11
14. OX06 – well drive, Tube 1
15. ET06 - BOE
16. CL01 – RCA Clean
17. OX05 – pad oxide, Tube 4
18. CV02 - 3500 Å
19. PH03 – 2 - Active
20. ET29 – LAM 490
21. ET07 – Branson Asher
22. PH03 – 3 - p-well stop
23. IM01- stop B11
24. ET07- Branson Asher
25. CL01 – RCA Clean
26. OX04 – field, Tube 1
27. ET19 – Hot Phos
28. ET06 – BOE
29. OX04 – Kooi, Tube 1
30. IM01 – Blanket Vt
31. PH03 – 4 - PMOS Vt Adjust
32. IM01 – Vt- B11
33. ET07 – Branson Asher
34. ET06 - BOE
35. CL01 – RCA Clean
36. OX06 – gate, Tube 4
37. CV01 – Poly 5000A
38. IM01 - dope poly
39. OX08 – Anneal, Tube 3
40. DE01 – 4pt probe
41. PH03 – 5 – poly
42. ET08 – LAM 490
43. ET07 – Branson Asher
44. PH03 – 6 - n-LDD
45. IM01 – LDD P31
46. ET07 – Branson Asher
47. PH03 – 7 - p-LDD
48. IM01 – LDD B11
49. ET07 – Branson Asher
50. CL01- RCA Clean
51. CV03 –TEOS, 5000A
52. ET10 – Drytek Quad
53. PH03 – 8 - N+D/S
54. IM01 – N+D/S P31
55. ET07 – Branson Asher
56. PH03 – 9 P+ D/S
57. IM01 – P+ D/S B11
58. ET07 – Branson Asher
59. CL01 Special - No HF Dip
60. OX08 – DS Anneal, Tube 2,3
61. CV03 – TEOS, 5000A
62. PH03 – 10 CC
63. ET06 – Drytek Quad / BOE
64. ET07 – Branson Asher
65. CL01 Special - Two HF Dips
66. ME01- CVC 601
67. PH03 -11- metal
68. ET15 – plasma Etch Al
69. ET07 – Solvent + Asher
70. SI01 – Sinter Tube 2
71. CV03 – TEOS- 5000Å
72. PH03 – VIA
73. ET06 – Drytek Quad / BOE
74. ET07- Strip Resist
75. ME01- PE 2800
76. PH03 - M2
77. ET15 -plasma Etch Al
78. ET07 – Solvent + Asher
79. SEM1 - pictures
80. TE01
81. TE02
82. TE03
83. TE04

8-16-09



JOHN GALT PRODUCT



Areas of interest

SMALL NMOSFET →

SMALL PMOSFET →

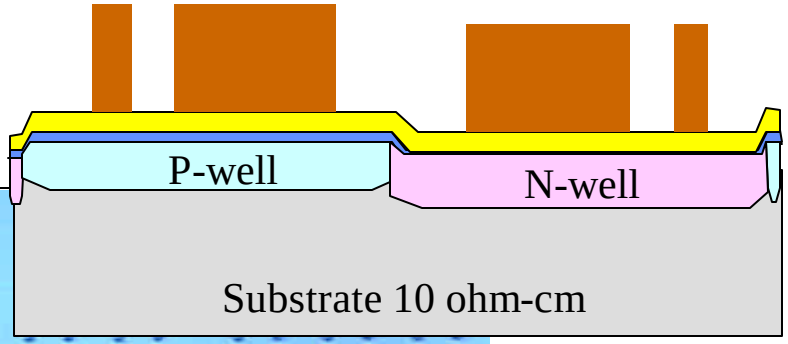
RING OSCILLATOR →

BIG NMOSFET →

BIG PMOSFET →

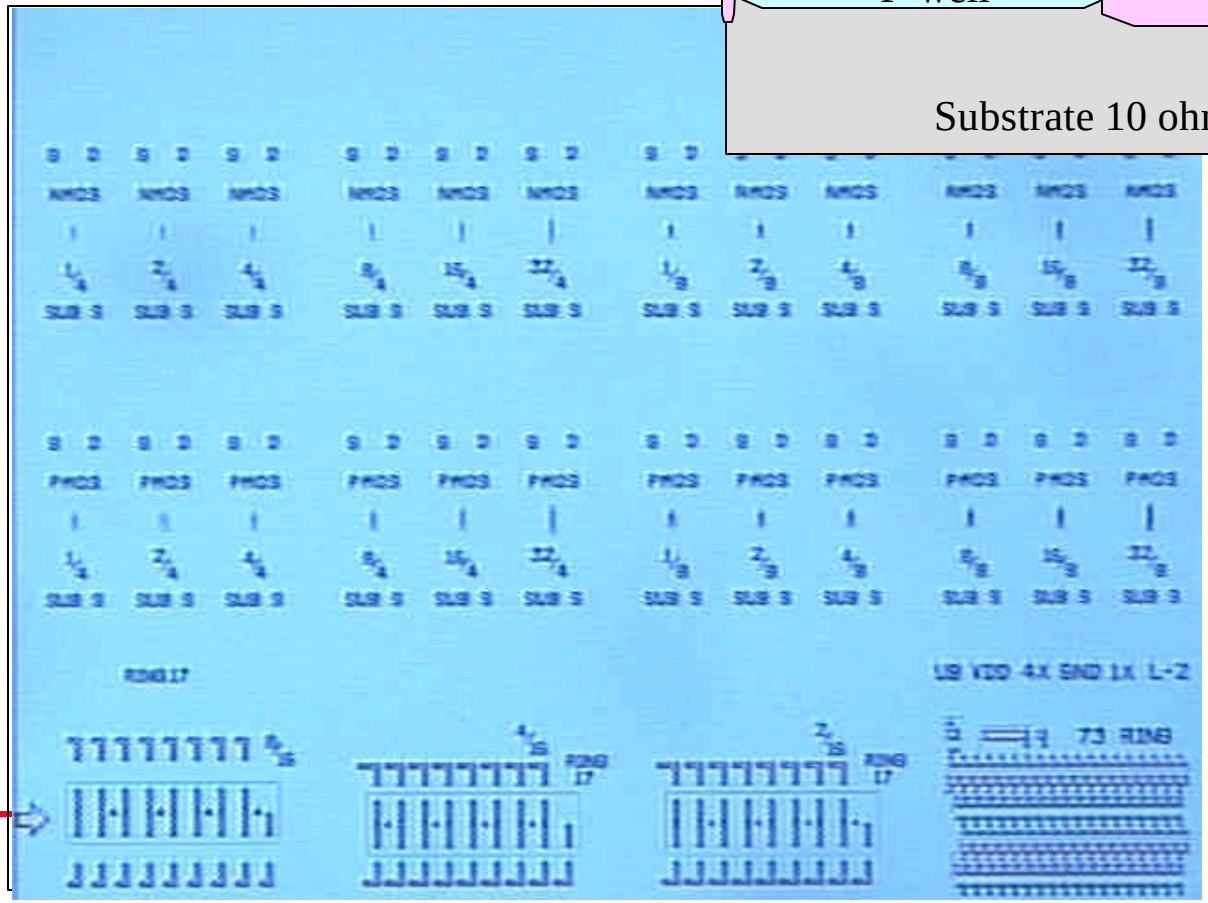
STEP 19 – PH03 LEVEL 2 ACTIVE

SMALL NMOS / PMOS



SMALL NMOS
Column 1 – Row 13

SMALL PMOS
Column 1 – Row 14

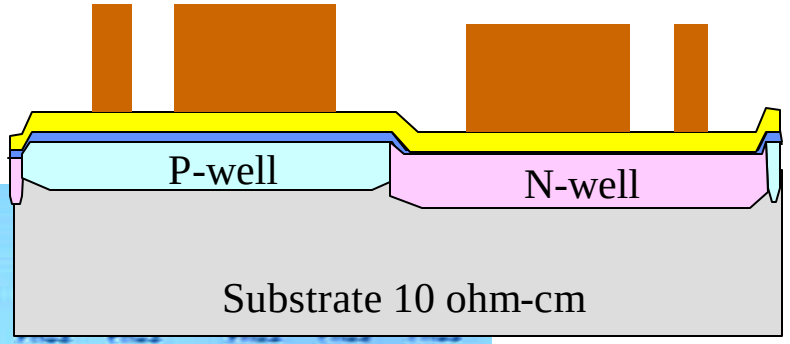


Mag = 2.5X

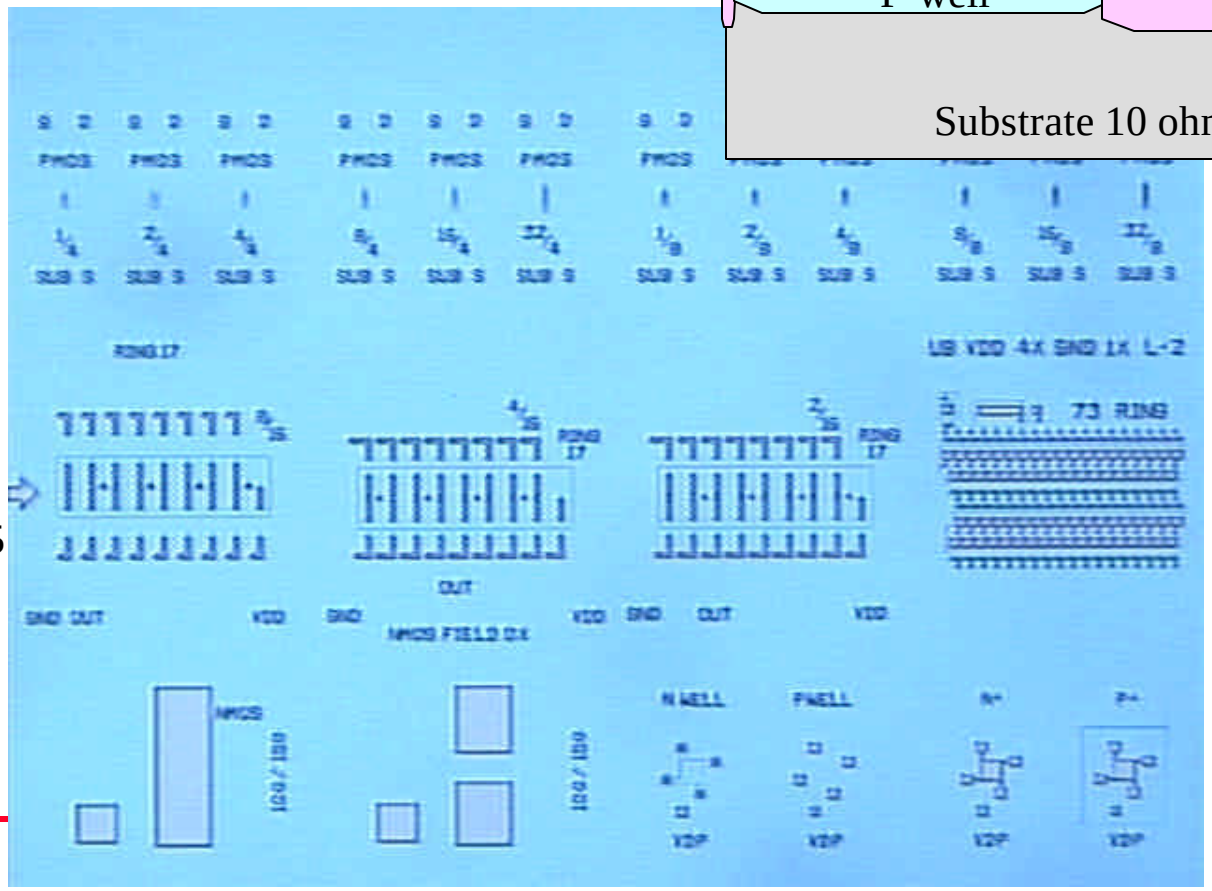
PLAY

STEP 19 – PH03 LEVEL 2 ACTIVE

RING OSCILLATOR



Ring Oscillator
Column 1 – Row 15

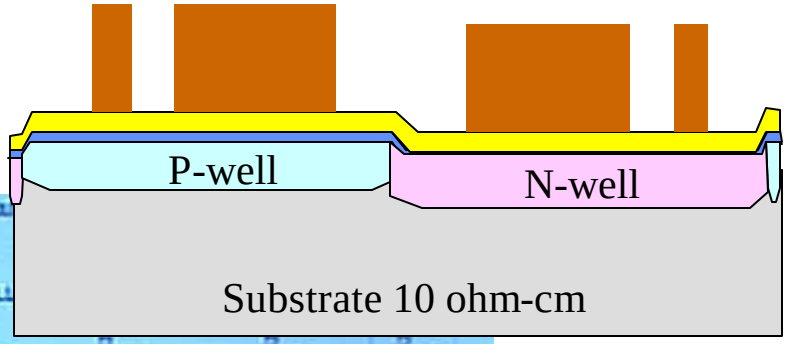


Mag = 2.5X

PLAY

STEP 19 – PH03 LEVEL 2 ACTIVE

BIG NMOS / PMOS



BIG NMOS
Column 1 – Row 16

BIG PMOS
Column 1 – Row 17

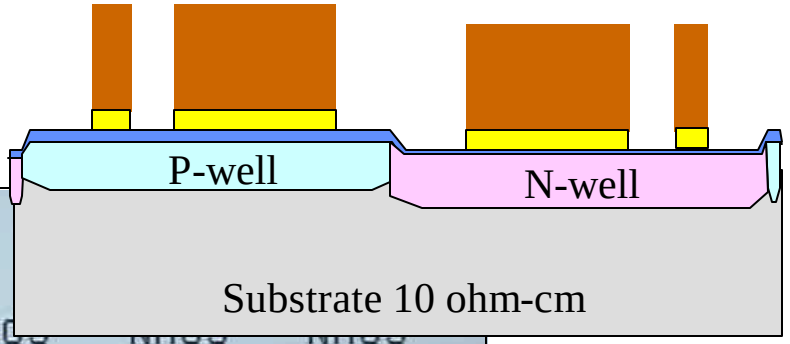
Alignment marks
Column 1 – Row 18

Mag = 2.5X

PLAY

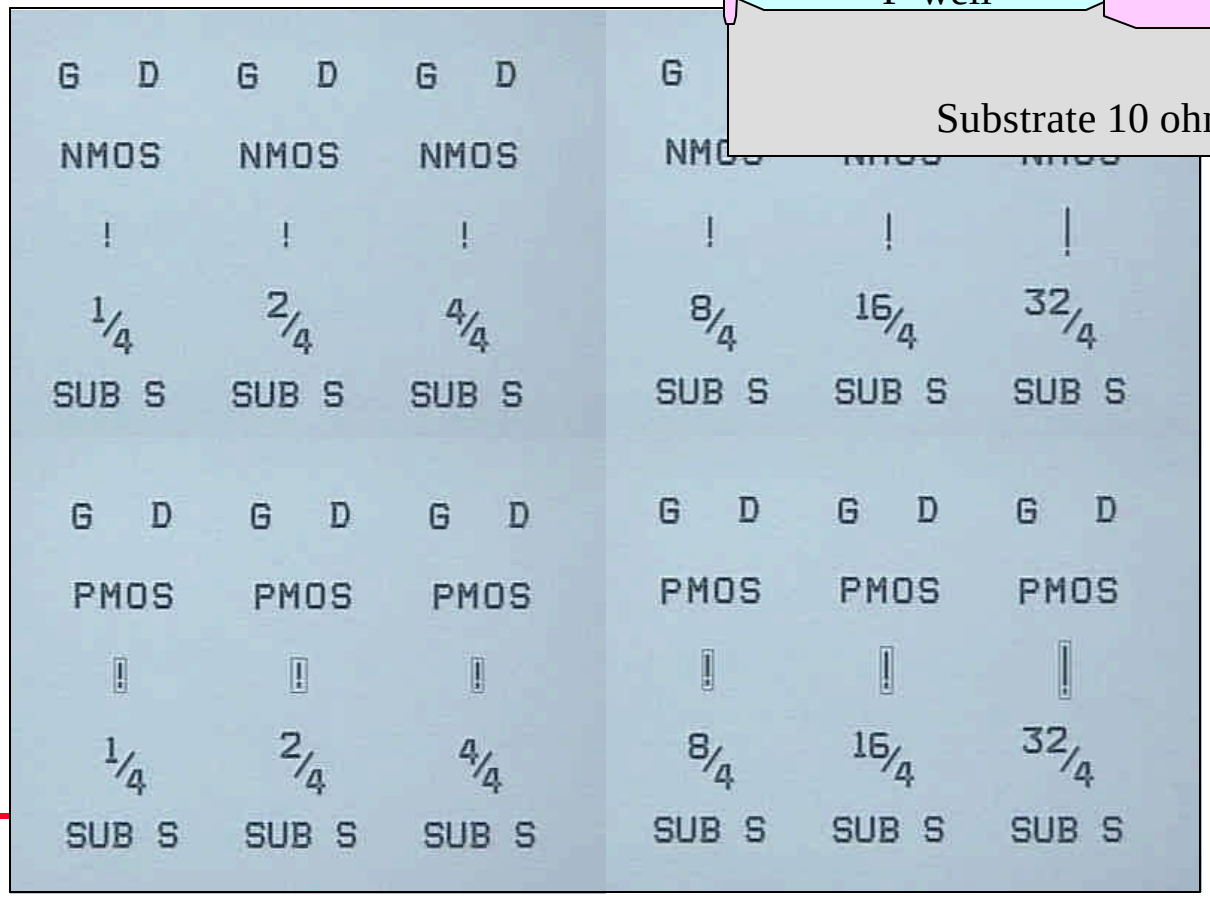
STEP 20 – ET29 NITRIDE ETCH

SMALL NMOS / PMOS



SMALL NMOS
Column 1 – Row 13

SMALL PMOS
Column 1 – Row 14

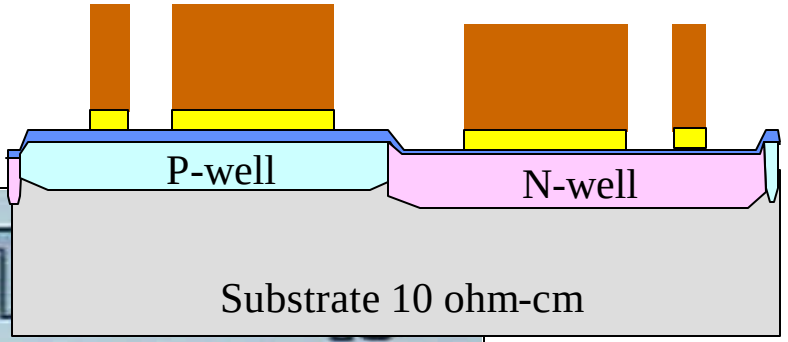


Mag = 10X

PLAY

STEP 20 – ET29 NITRIDE ETCH

RING OSCILLATOR



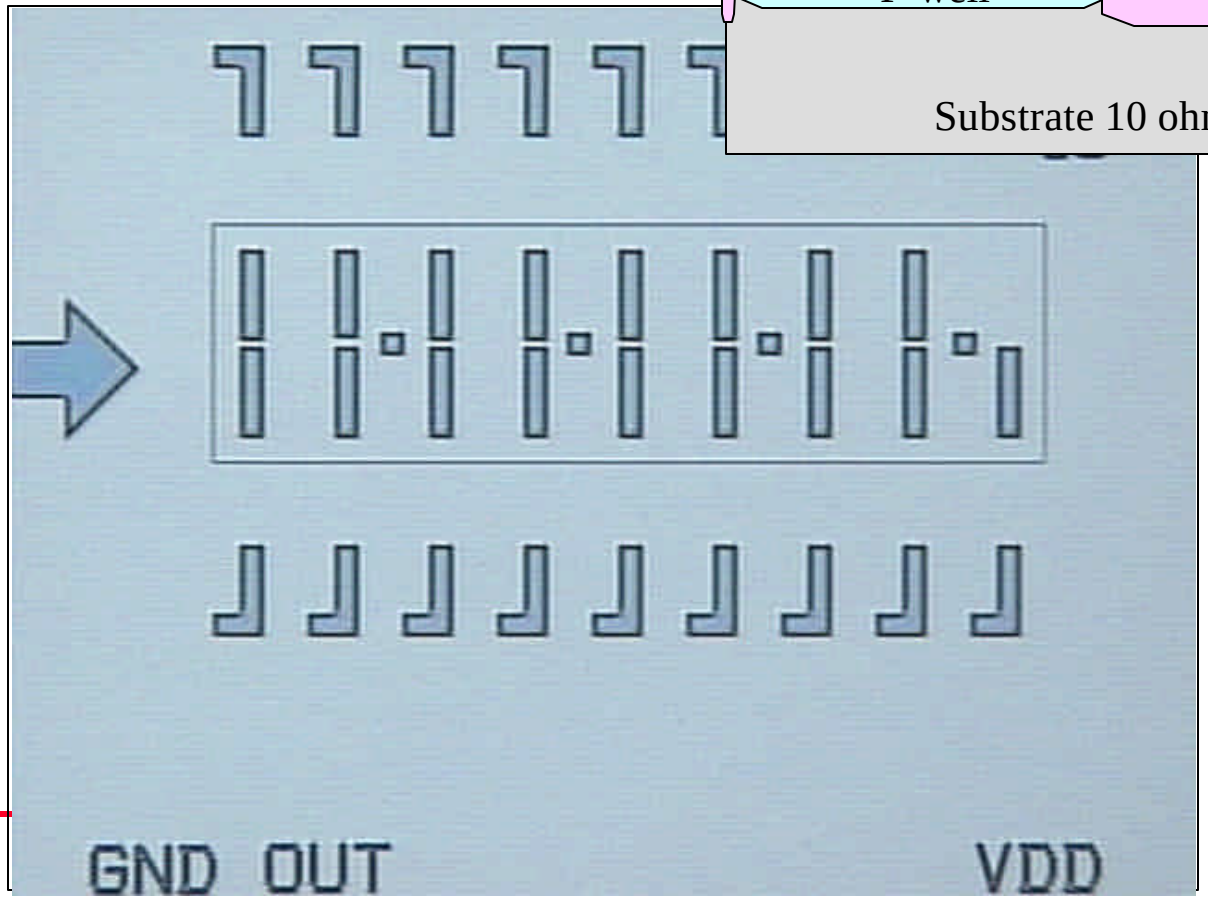
NMOS

PMOS

Column 1 – Row 15

PMOS

NMOS

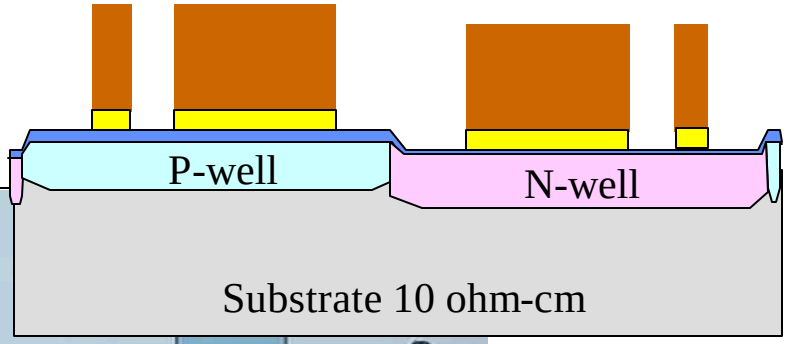


Mag = 10X

PLAY

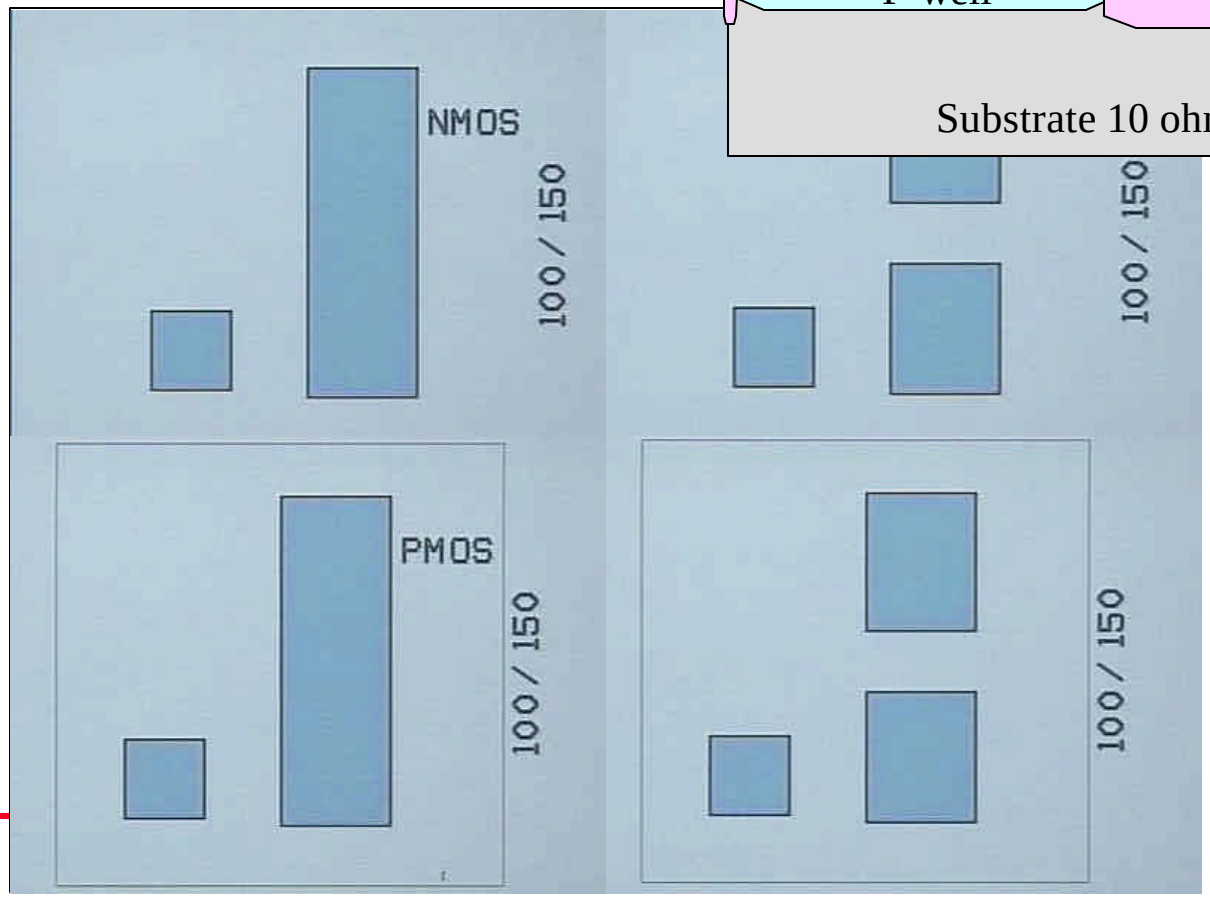
STEP 20 – ET29 NITRIDE ETCH

BIG NMOS / PMOS



BIG NMOS
Column 1 – Row 16

BIG PMOS
Column 1 – Row 17

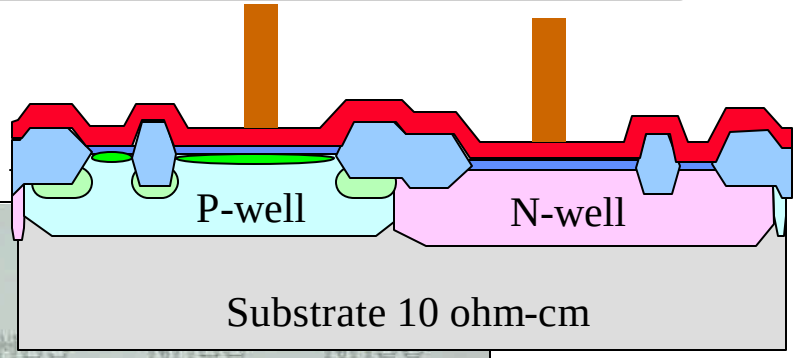


Mag = 10X

PLAY

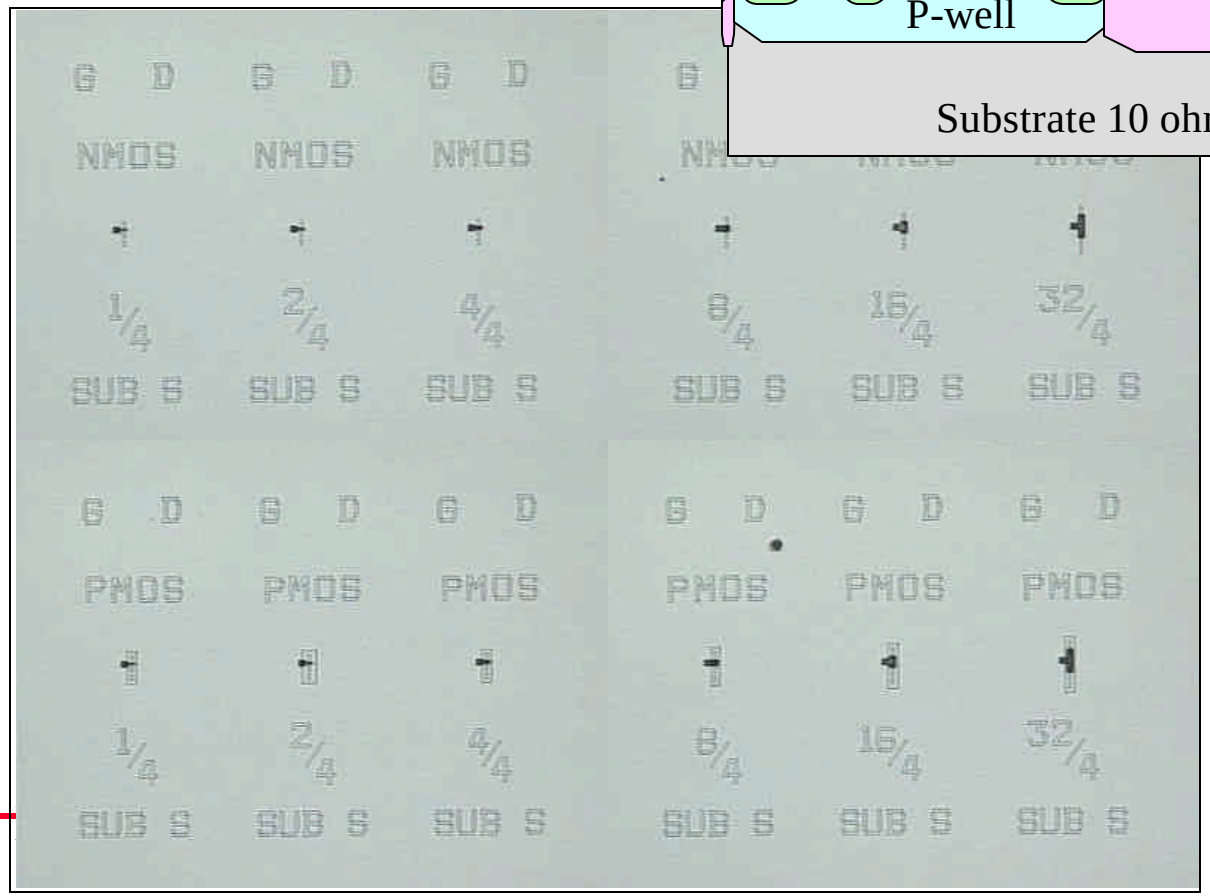
STEP 41 – PH03 LEVEL 5 - POLY

SMALL NMOS / PMOS



SMALL NMOS
Column 1 – Row 13

SMALL PMOS
Column 1 – Row 14

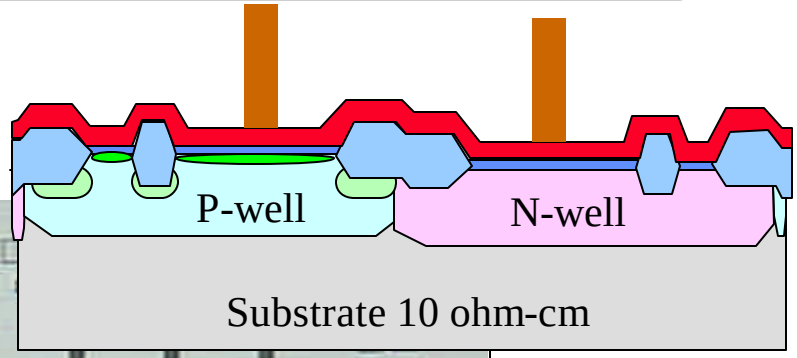


Mag = 10X

PLAY

STEP 41 – PH03 LEVEL 5 - POLY

RING OSCILLATOR



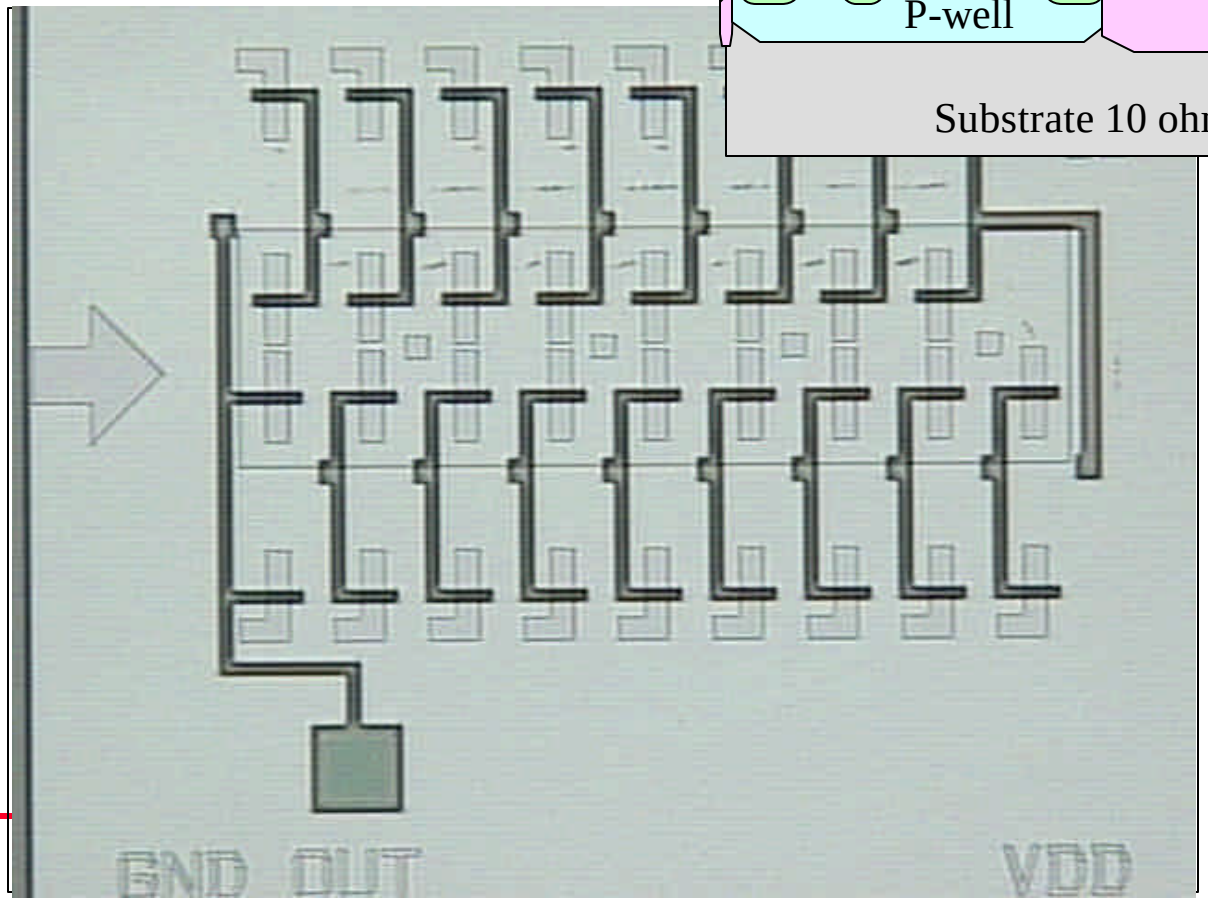
NMOS

PMOS

Column 1 – Row 15

PMOS

NMOS

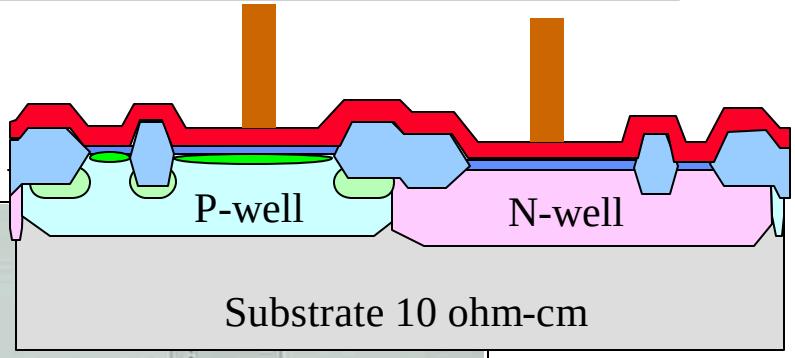


Mag = 10X

PLAY

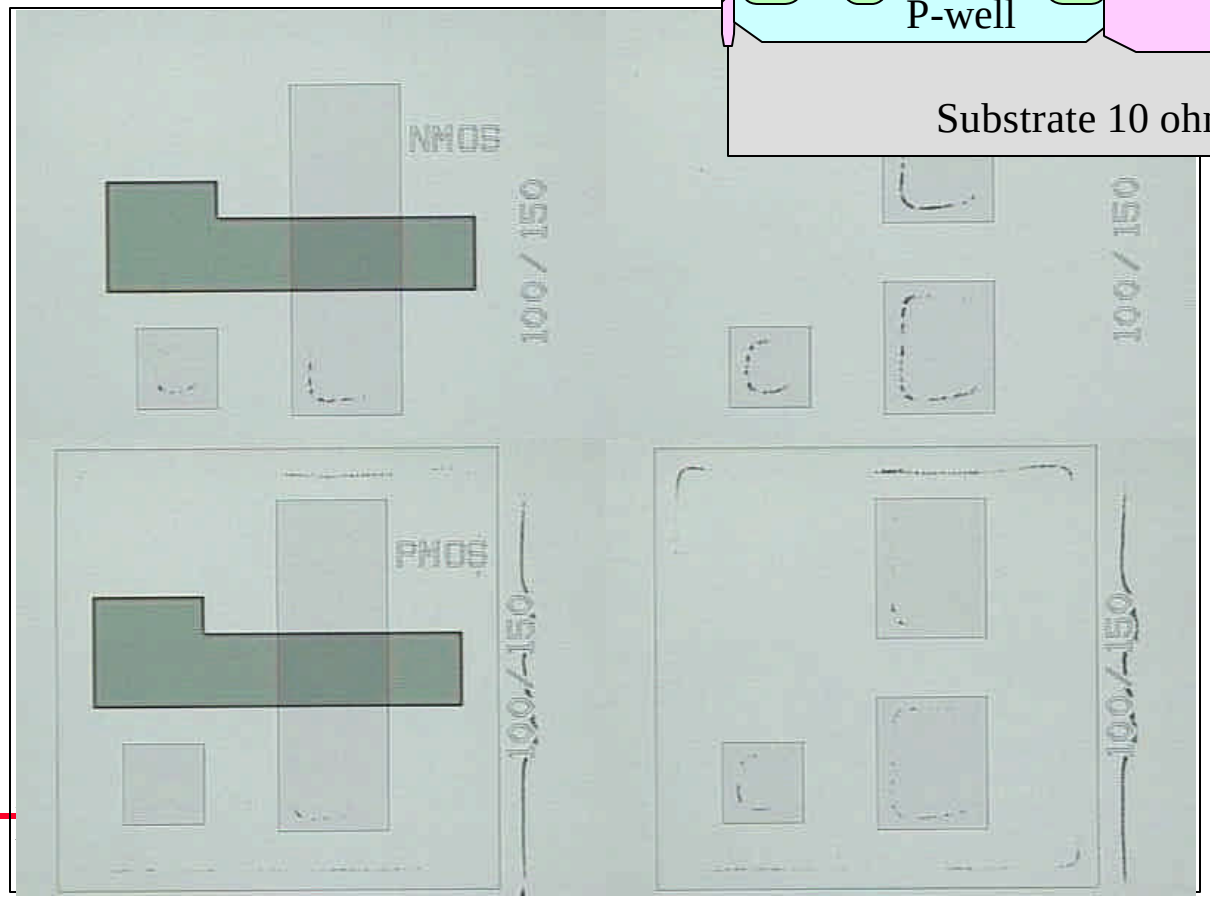
STEP 41 – PH03 LEVEL 5 - POLY

BIG NMOS / PMOS



BIG NMOS
Column 1 – Row 16

BIG PMOS
Column 1 – Row 17

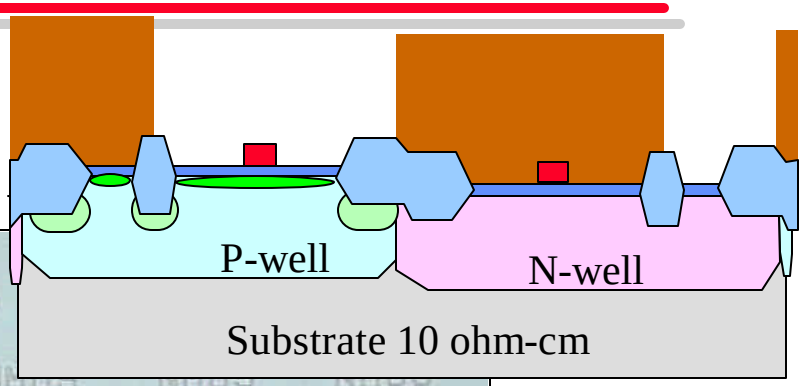


Mag = 10X

PLAY

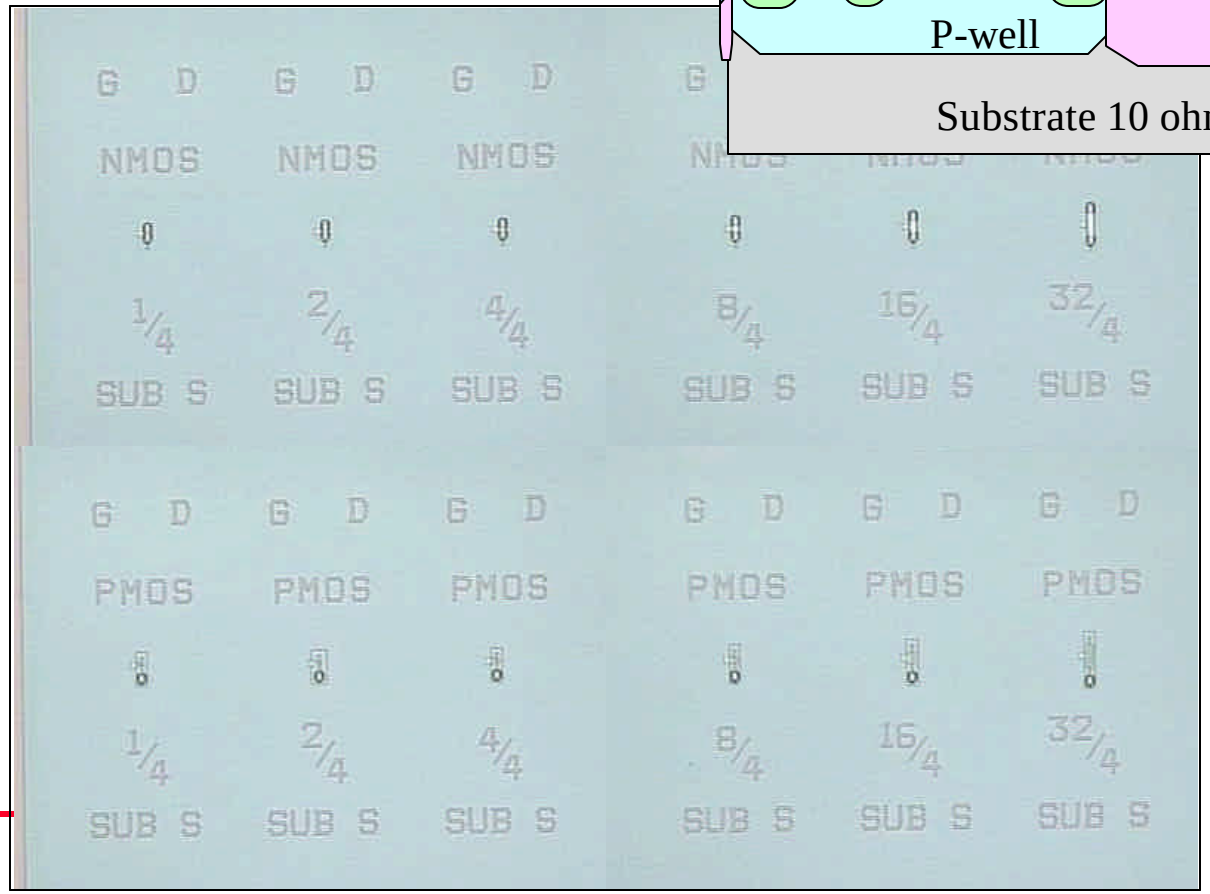
STEP 44 – PH03 – LEVEL 6 – N-LDD

SMALL NMOS / PMOS



SMALL NMOS
Column 1 – Row 13

SMALL PMOS
Column 1 – Row 14

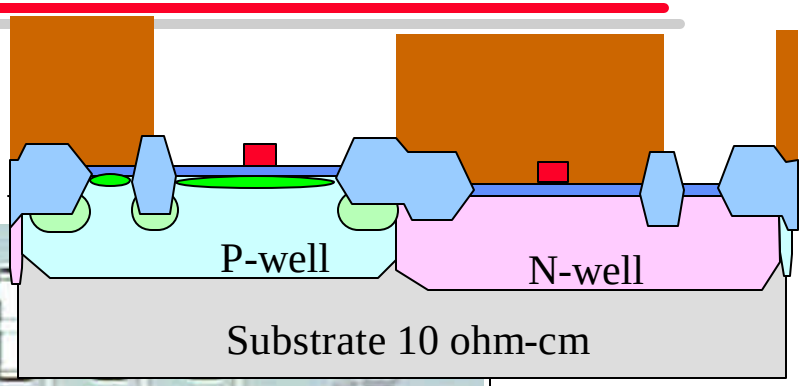


Mag = 10X

PLAY

STEP 44 – PH03 – LEVEL 6 – N-LDD

RING OSCILLATOR



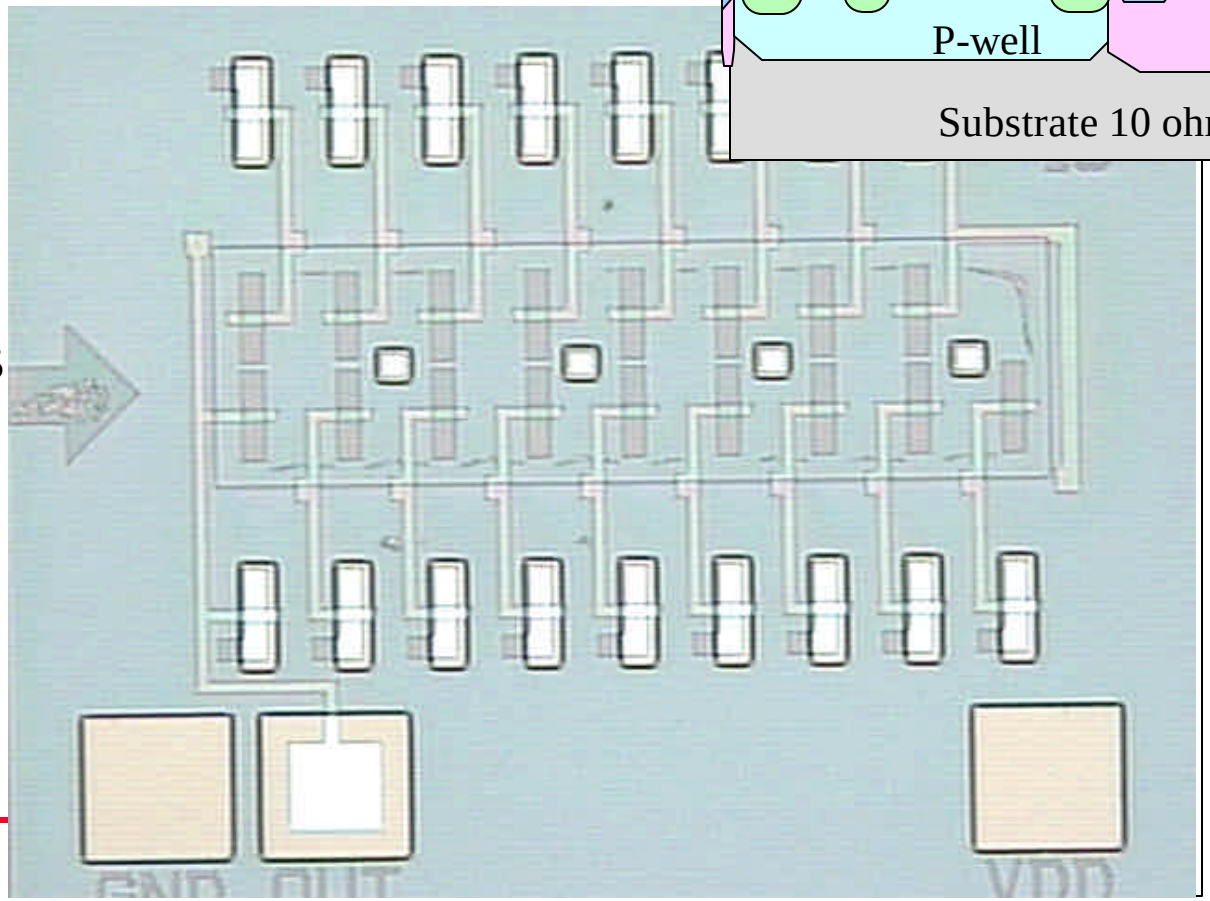
NMOS

PMOS

Column 1 – Row 15

PMOS

NMOS

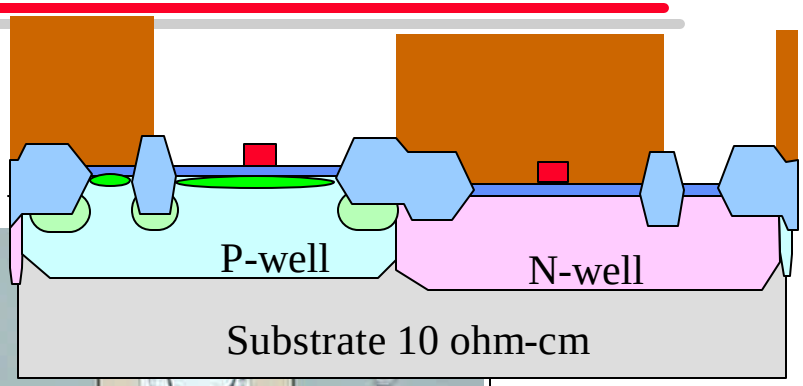


Mag = 10X

PLAY

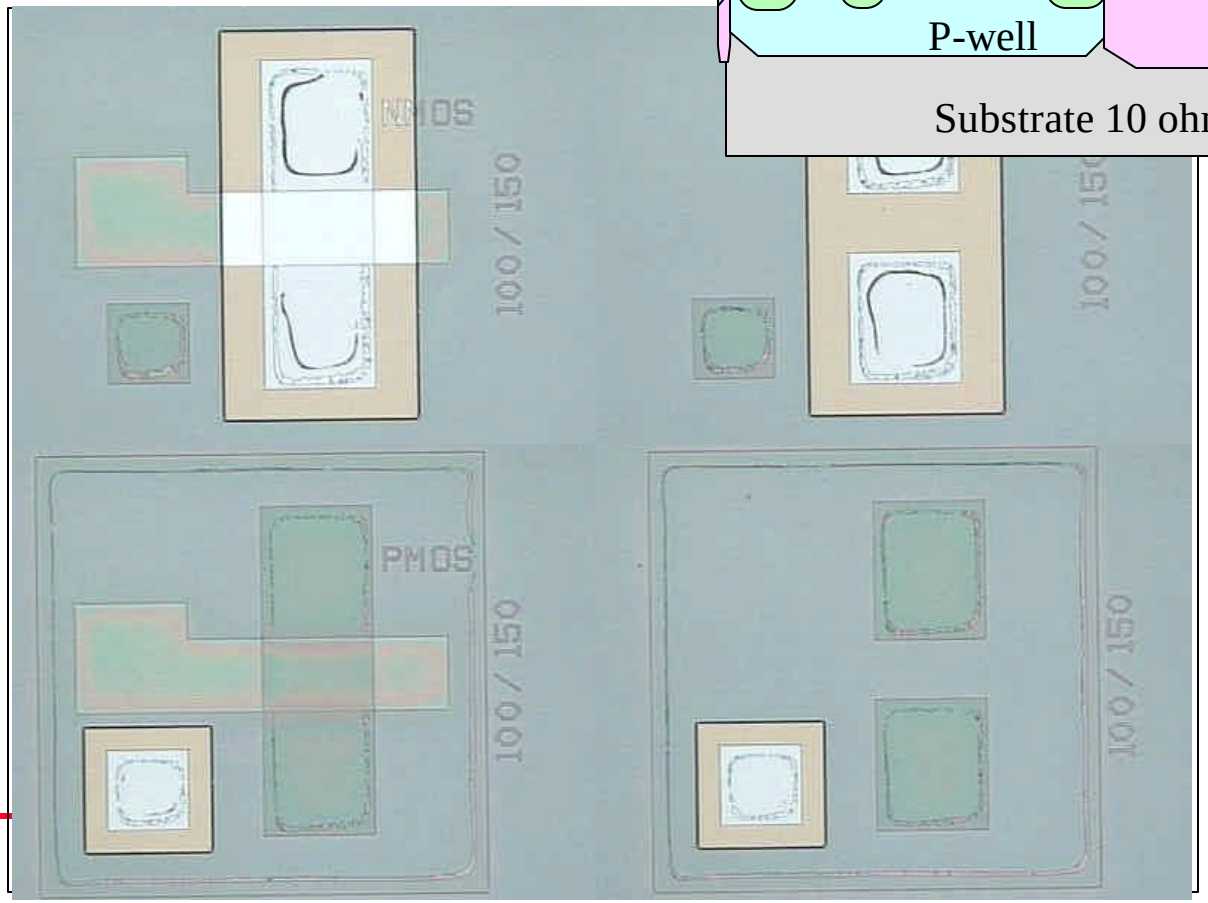
STEP 44 – PH03 – LEVEL 6 – N-LDD

BIG NMOS / PMOS



BIG NMOS
Column 1 – Row 16

BIG PMOS
Column 1 – Row 17

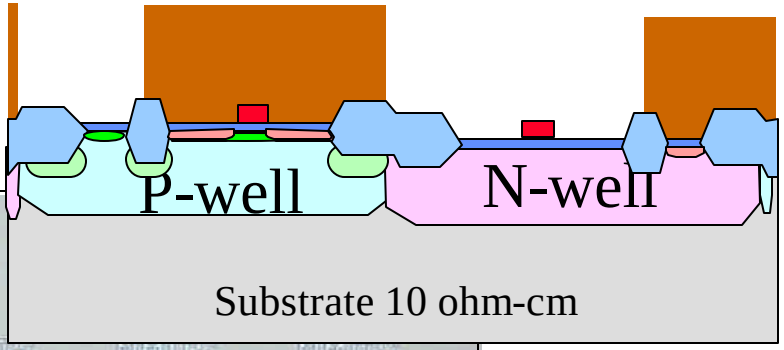


Mag = 10X

PLAY

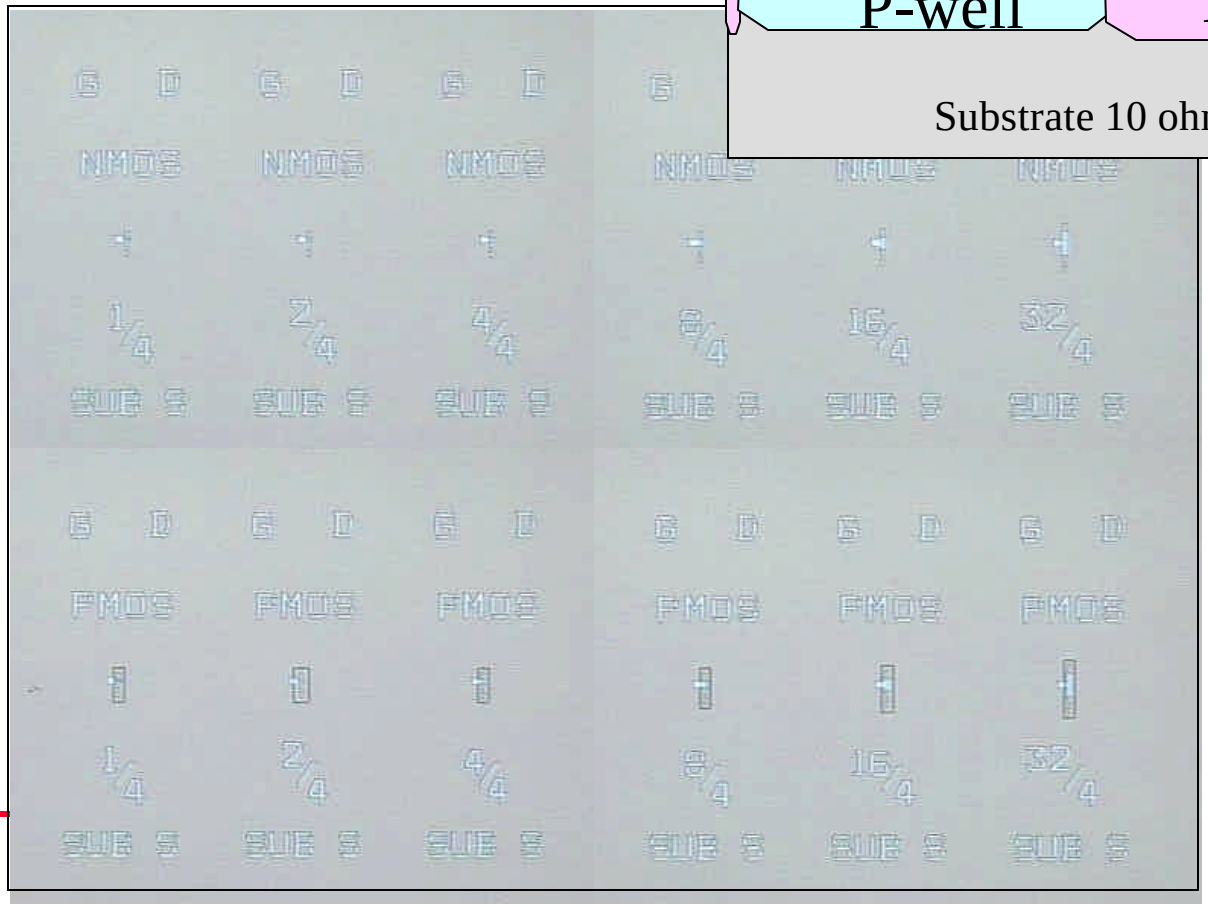
STEP 47 – PH03 LEVEL 7 P-LDD

SMALL NMOS / PMOS



SMALL NMOS
Column 1 – Row 13

SMALL PMOS
Column 1 – Row 14

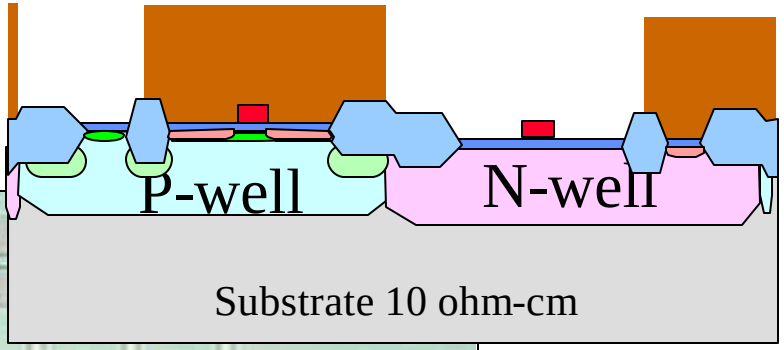


Mag = 10X

PLAY

STEP 47 – PH03 LEVEL 7 P-LDD

RING OSCILLATOR



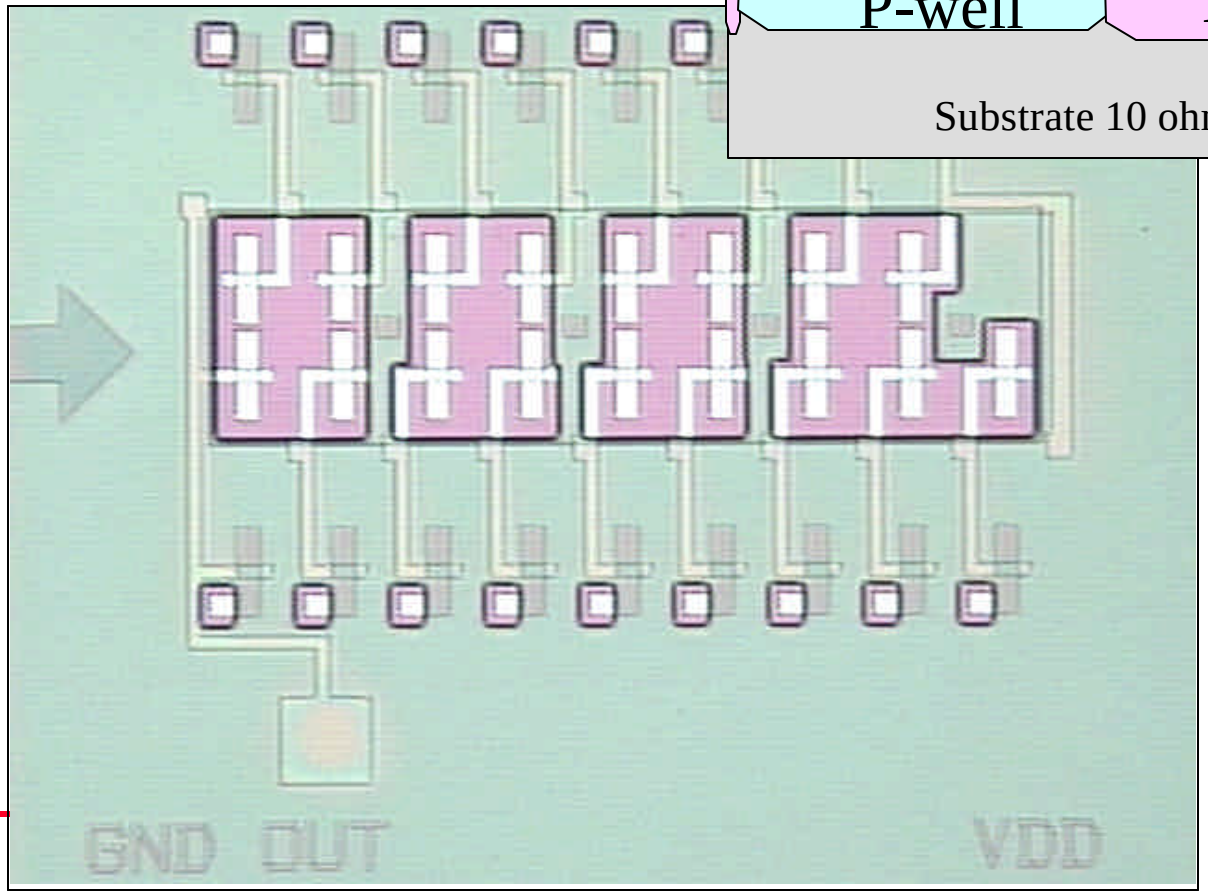
NMOS

PMOS

Column 1 – Row 15

PMOS

NMOS

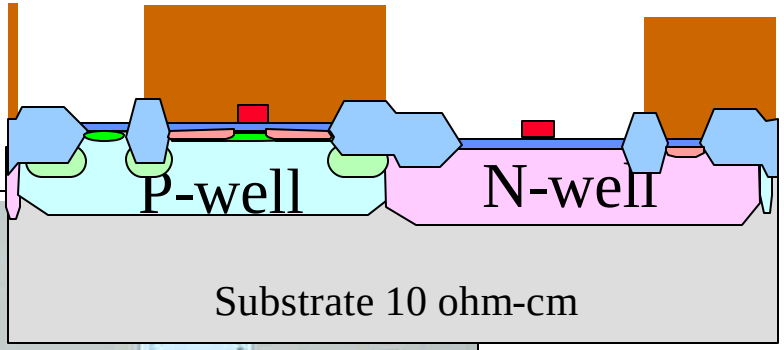


Mag = 10X

PLAY

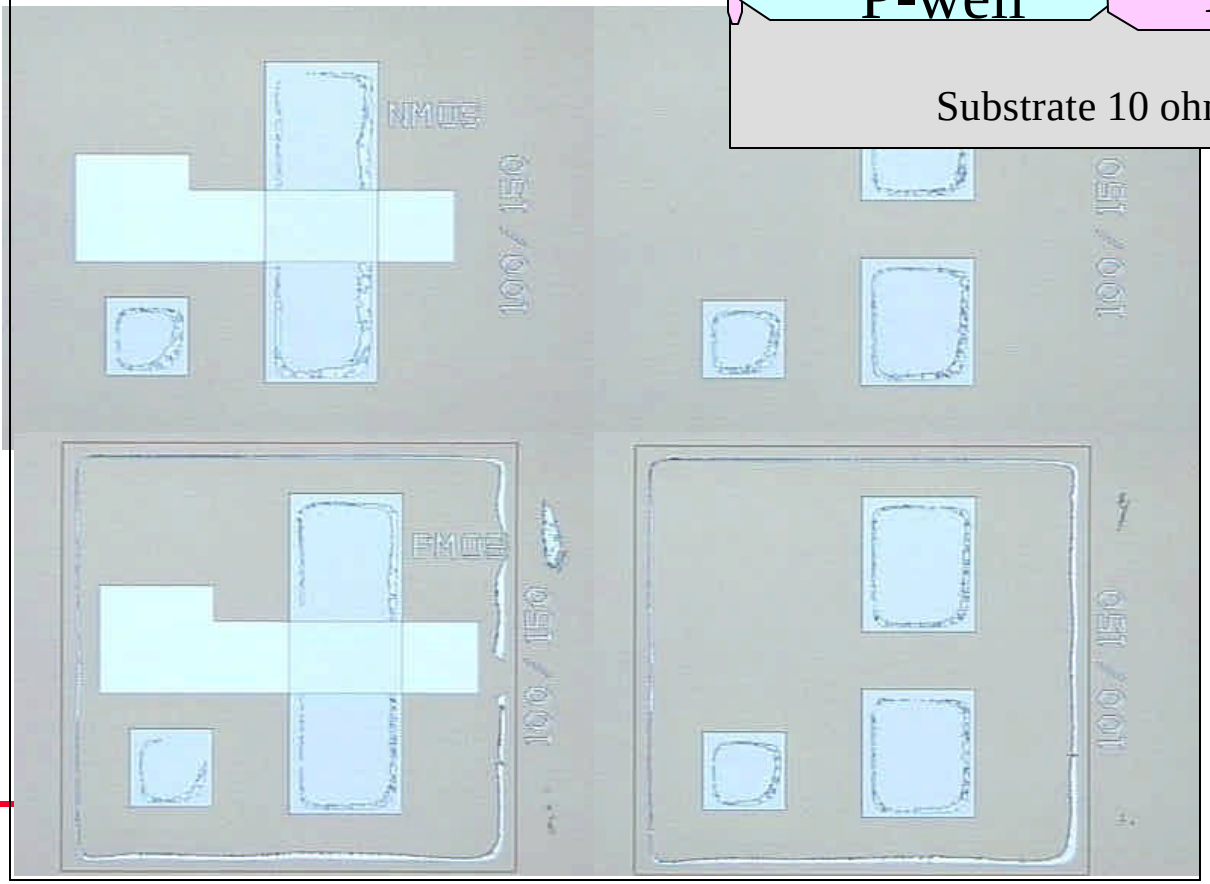
STEP 47 – PH03 LEVEL 7 P-LDD

BIG NMOS / PMOS



BIG NMOS
Column 1 – Row 16

BIG PMOS
Column 1 – Row 17

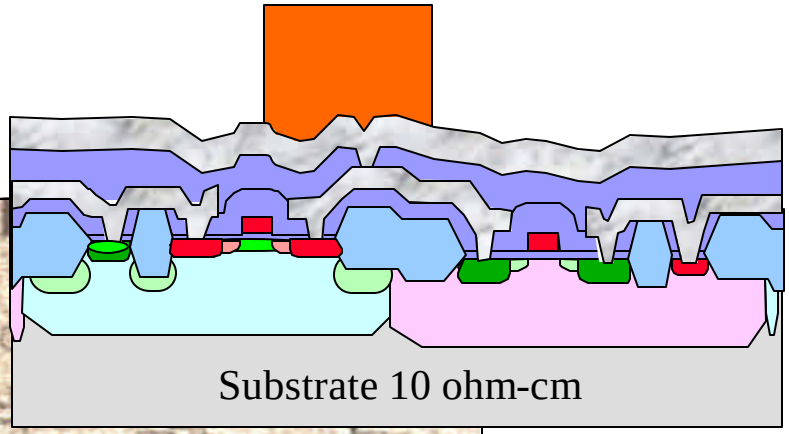


Mag = 10X

PLAY

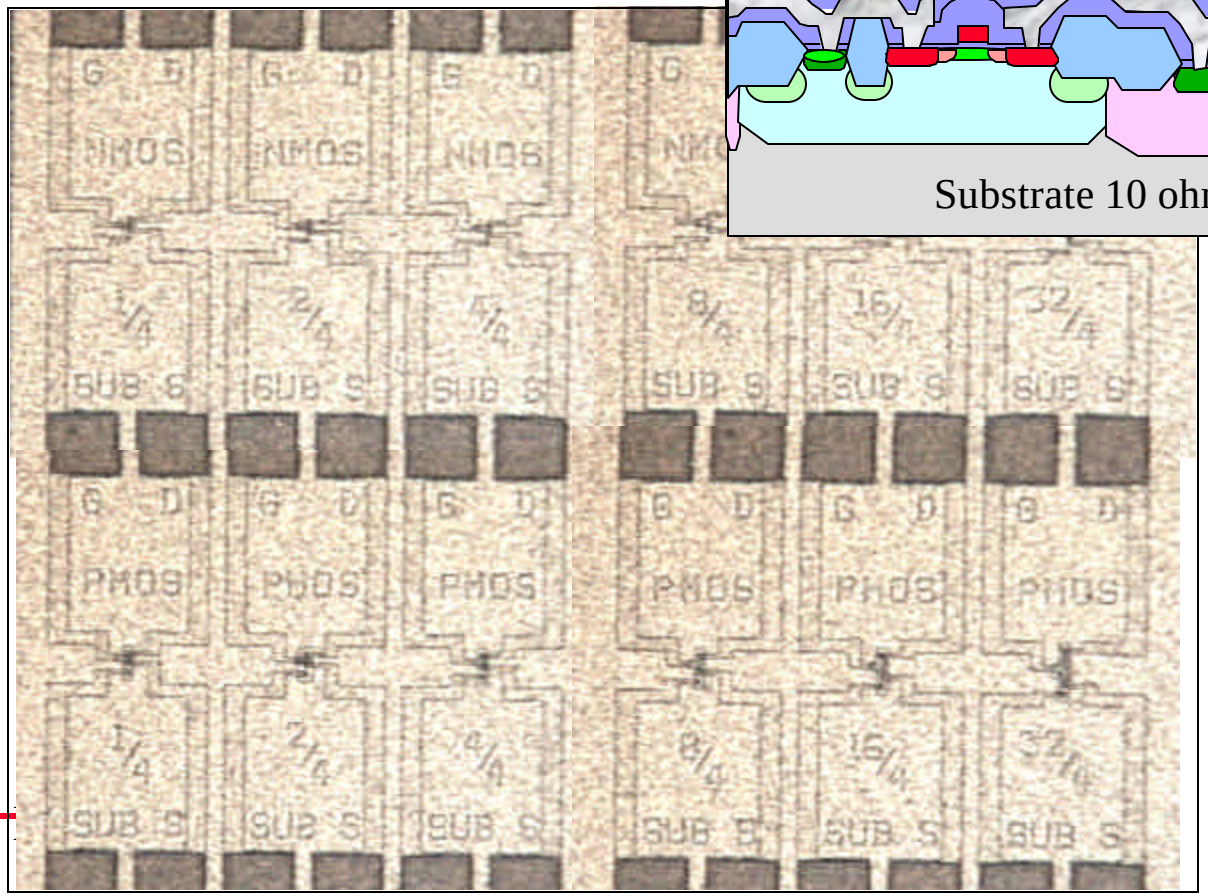
STEP 76 – PH03 LEVEL 13 METAL 2

SMALL NMOS / PMOS



SMALL NMOS
Column 1 – Row 13

SMALL PMOS
Column 1 – Row 14

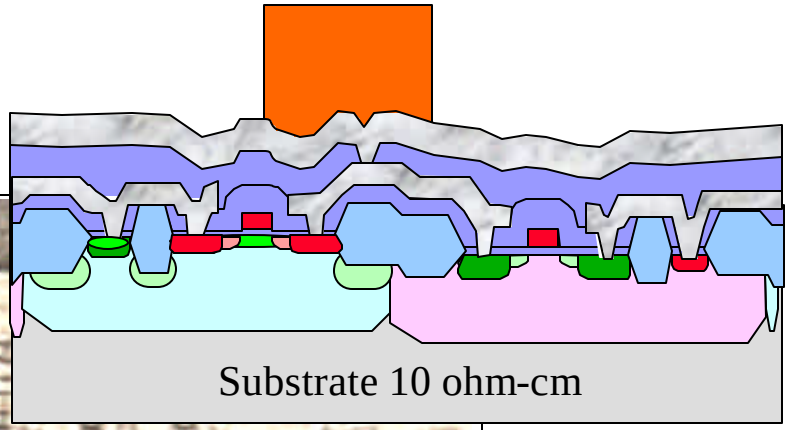


Mag = 10X

PLAY

STEP 76 – PH03 LEVEL 13 METAL 2

RING OSCILLATOR



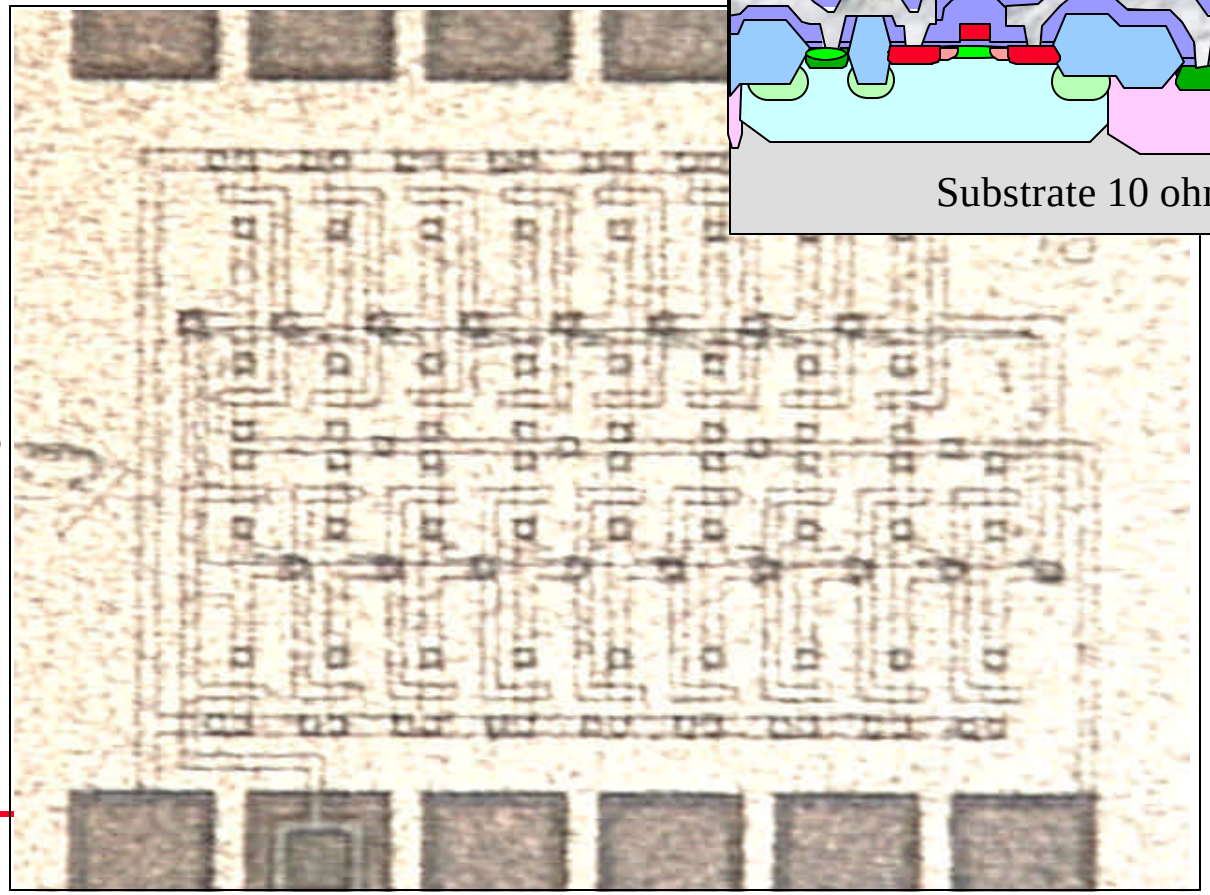
NMOS

PMOS

Column 1 – Row 15

PMOS

NMOS

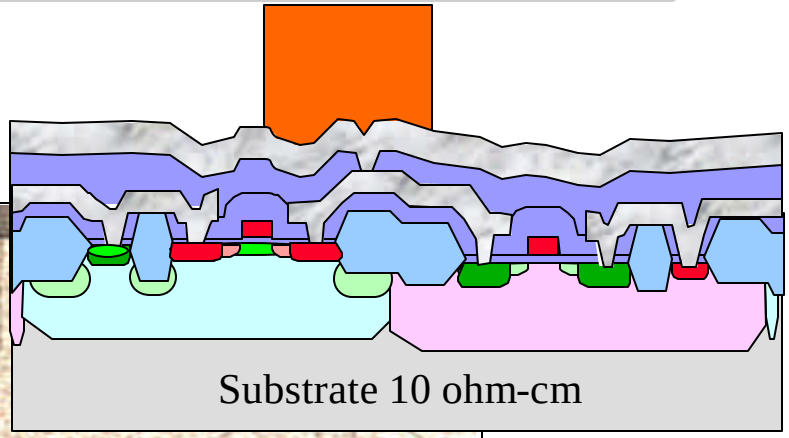


Mag = 10X

PLAY

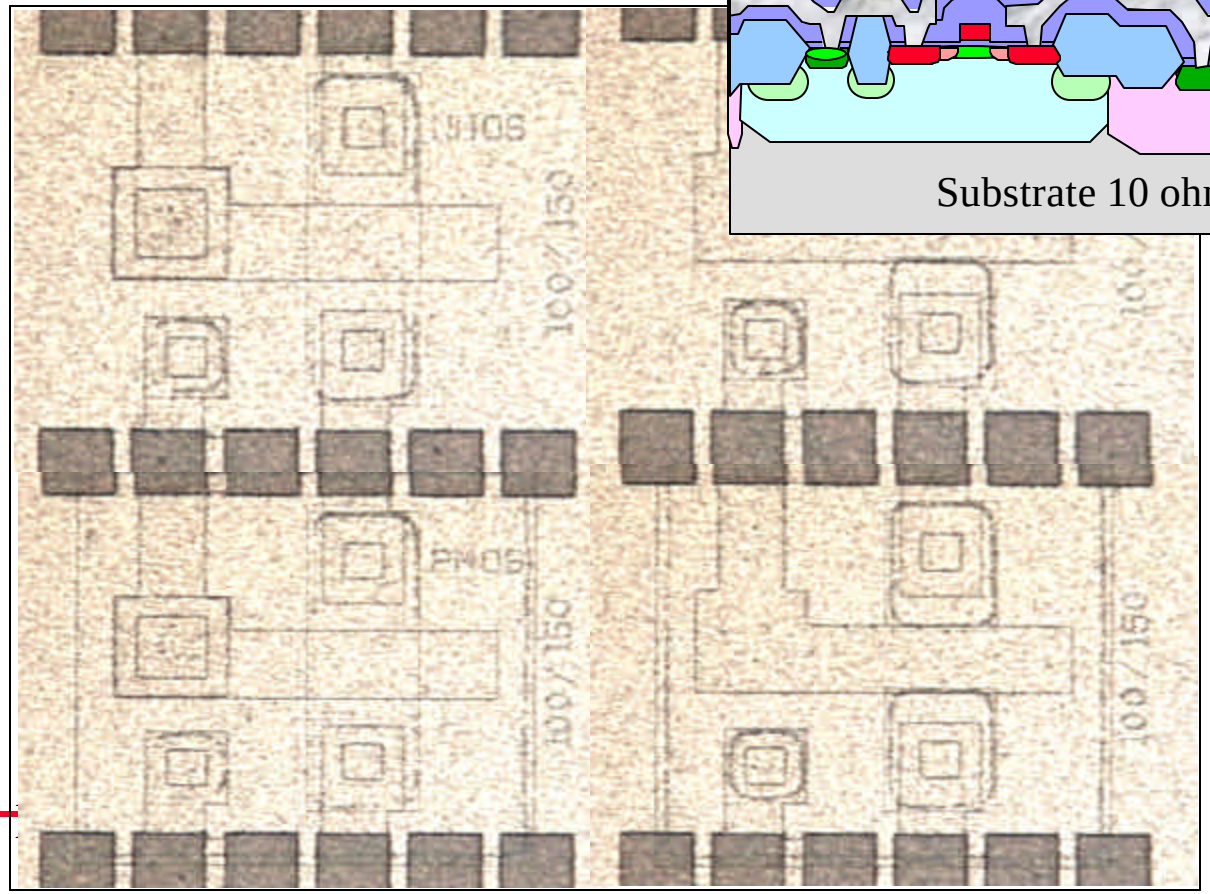
STEP 76 – PH03 LEVEL 13 METAL 2

BIG NMOS / PMOS



BIG NMOS
Column 1 – Row 16

BIG PMOS
Column 1 – Row 17

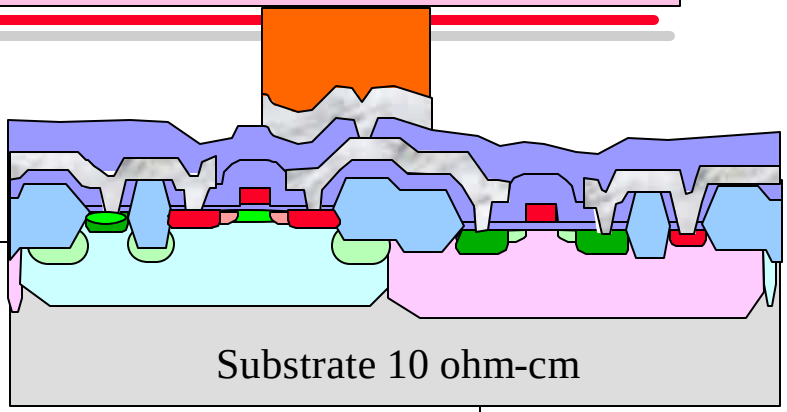


Mag = 10X

PLAY

STEP 77 – ET15 METAL 2 PLASMA ETCH

SMALL NMOS / PMOS



SMALL NMOS
Column 1 – Row 13

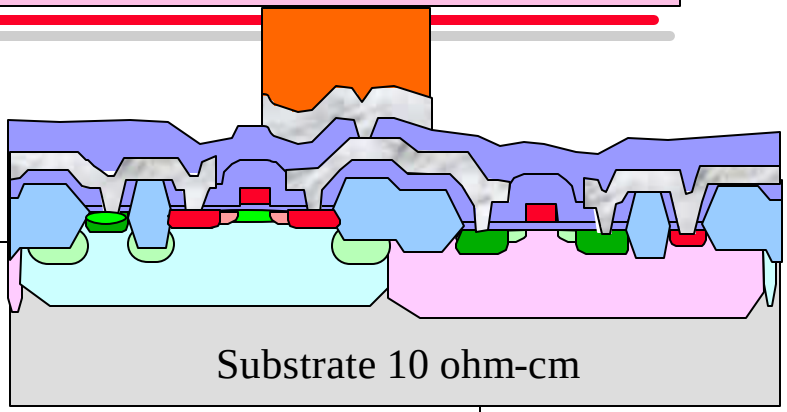
SMALL PMOS
Column 1 – Row 14

Mag = 10X

PLAY

STEP 77 – ET15 METAL 2 PLASMA ETCH

RING OSCILLATOR



NMOS

PMOS

Column 1 – Row 15

PMOS

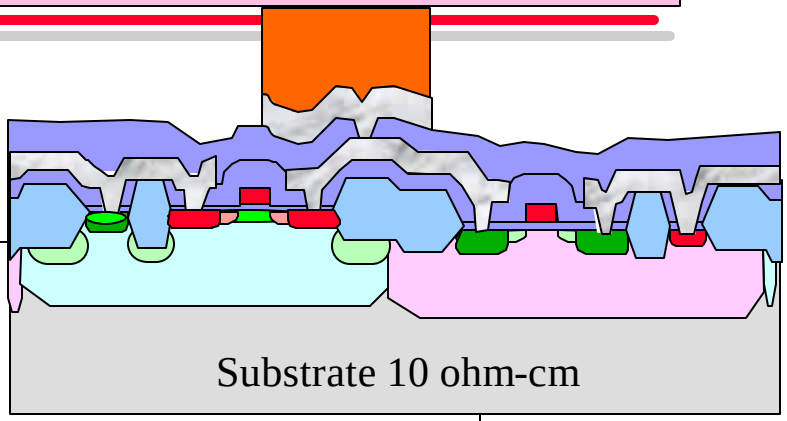
NMOS

Mag = 10X

PLAY

STEP 77 – ET15 METAL 2 PLASMA ETCH

BIG NMOS / PMOS



BIG NMOS
Column 1 – Row 16

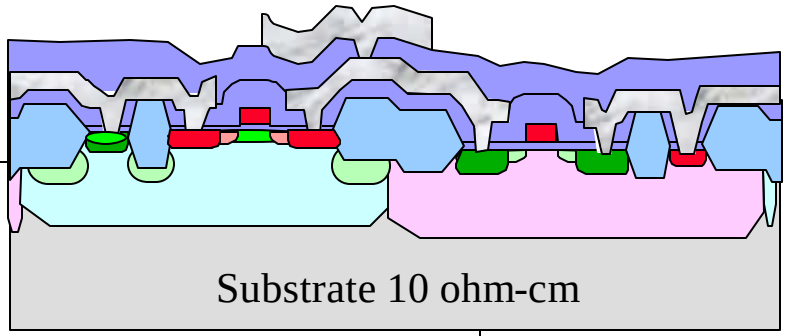
BIG PMOS
Column 1 – Row 17

Mag = 10X

PLAY

STEP 78 – ET07 RESIST STRIP

SMALL NMOS / PMOS



SMALL NMOS
Column 1 – Row 13

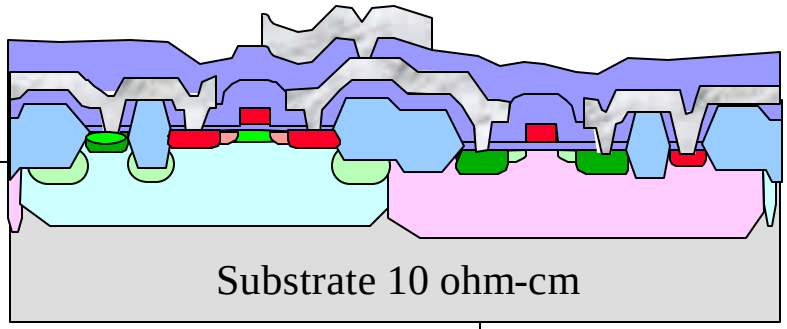
SMALL PMOS
Column 1 – Row 14

Mag = 10X

PLAY

STEP 78 – ET07 RESIST STRIP

RING OSCILLATOR



NMOS

PMOS

Column 1 – Row 15

PMOS

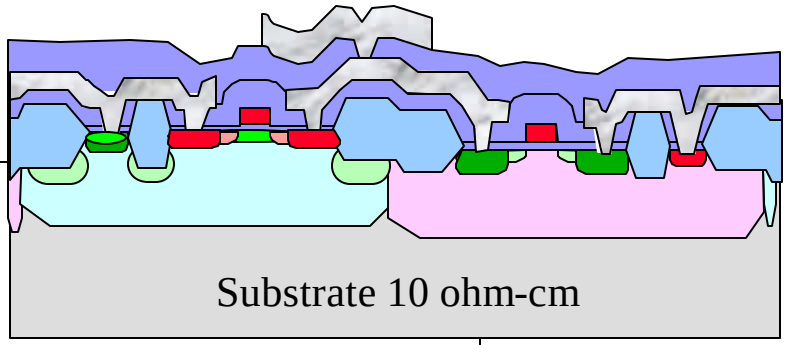
NMOS

Mag = 10X

PLAY

STEP 78 – ET07 RESIST STRIP

BIG NMOS / PMOS



BIG NMOS
Column 1 – Row 16

BIG PMOS
Column 1 – Row 17

Mag = 10X

PLAY