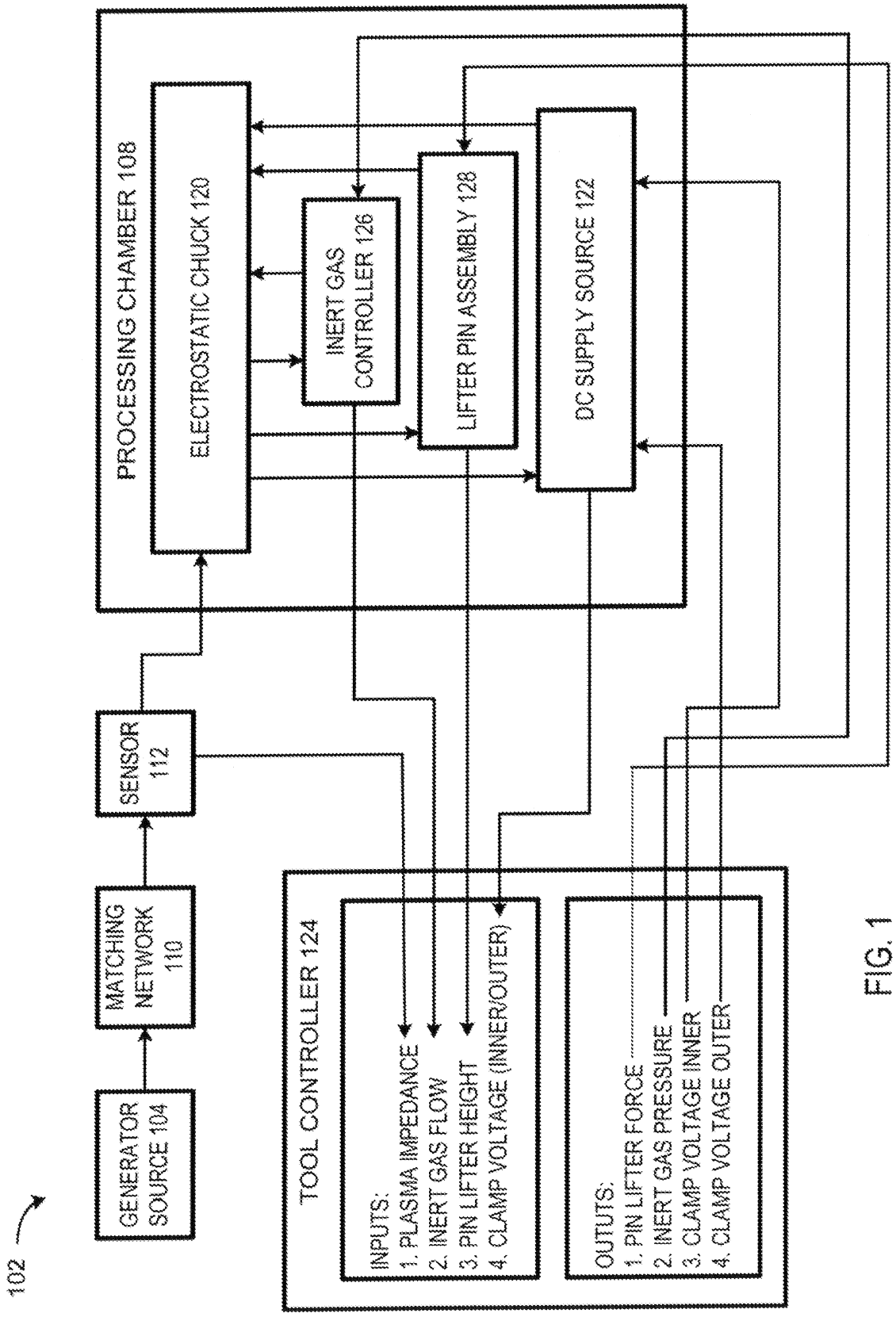
102
GENERATOR SOURCE 104
MATCHING NETWORK 110
SENSOR 112
PROCESSING CHAMBER 108
ELECTROSTATIC CHUCK 120
INERT GAS CONTROLLER 126
LIFTER PIN ASSEMBLY 128
DC SUPPLY SOURCE 122
TOOL CONTROLLER 124
INPUTS:
1. PLASMA IMPEDANCE
2. INERT GAS FLOW
3. PIN LIFTER HEIGHT
4. CLAMP VOLTAGE (INNER/OUTER)
OUTUTS:
1. PIN LIFTER FORCE
2. INERT GAS PRESSURE
3. CLAMP VOLTAGE INNER
4. CLAMP VOLTAGE OUTER

FIG. 1

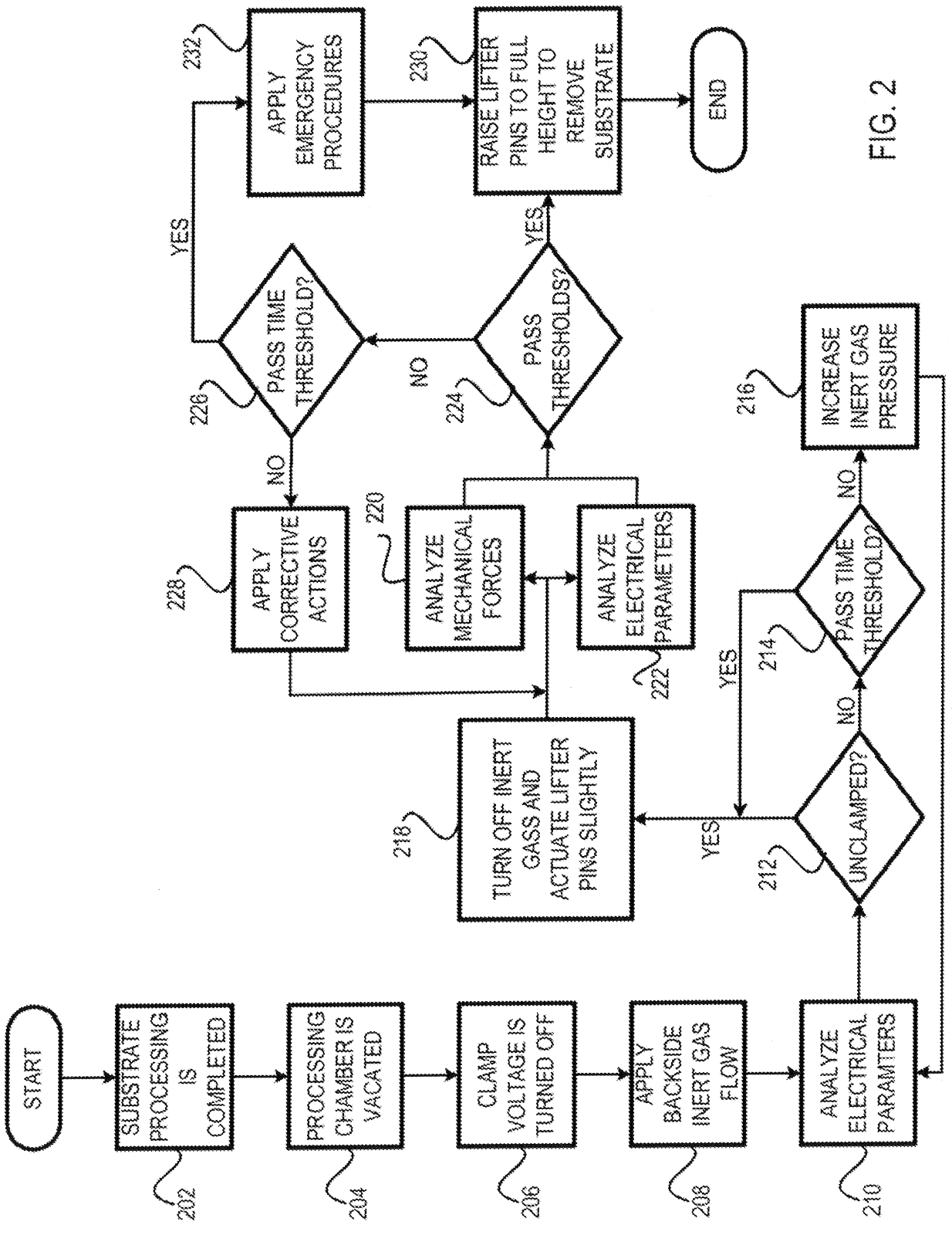
START
SUBSTRATE PROCESSING IS COMPLETED
202
PROCESSING CHAMBER IS VACATED
204
CLAMP VOLTAGE IS TURNED OFF
206
APPLY BACKSIDE INERT GAS FLOW
208
ANALYZE ELECTRICAL PARAMITERS
210
UNCLAMPED?
212
NO
YES
PASS TIME THRESHOLD?
214
NO
INCREASE INERT GAS PRESSURE
216
YES
TURN OFF INERT GASS AND ACTUATE LIFTER PINS SLIGHTLY
218
ANALYZE MECHANICAL FORCES
220
ANALYZE ELECTRICAL PARAMETERS
222
PASS THRESHOLDS?
224
NO
YES
PASS TIME THRESHOLD?
226
NO
YES
APPLY CORRECTIVE ACTIONS
228
APPLY EMERGENCY PROCEDURES
232
RAISE LIFTER PINS TO FULL HEIGHT TO REMOVE SUBSTRATE
230
END

FIG. 2

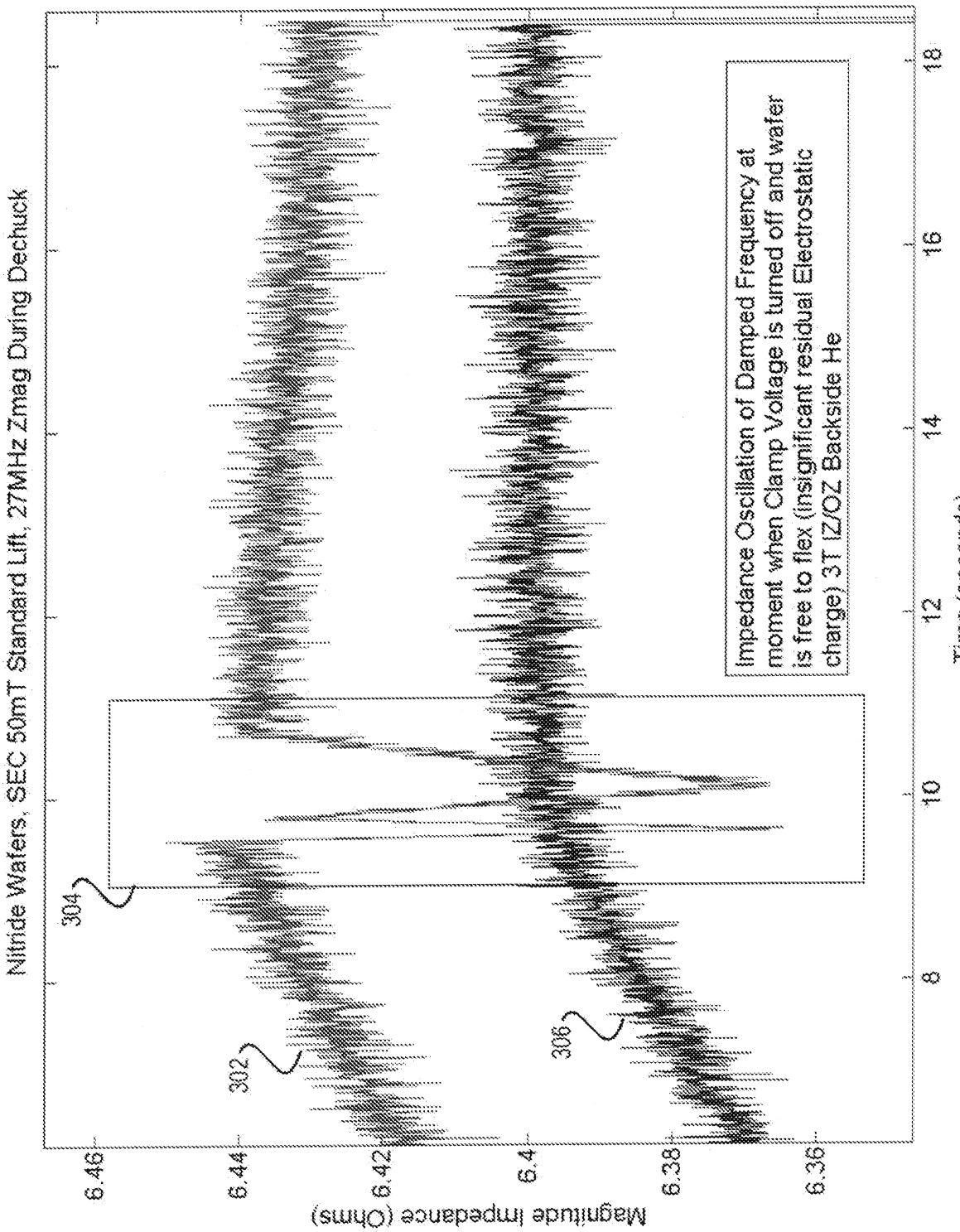
Nitride Wafers, SEC 50mT Standard Lift, 27MHz Zmag During Dechuck
Magnitude Impedance (Ohms)
Time (seconds)
6.46
6.44
6.42
6.4
6.38
6.36
8
10
12
14
16
18
304
302
306
Impedance Oscillation of Damped Frequency at moment when Clamp Voltage is turned off and wafer is free to flex (insignificant residual Electrostatic charge) 3T IZ/OZ Backside He

FIG. 3

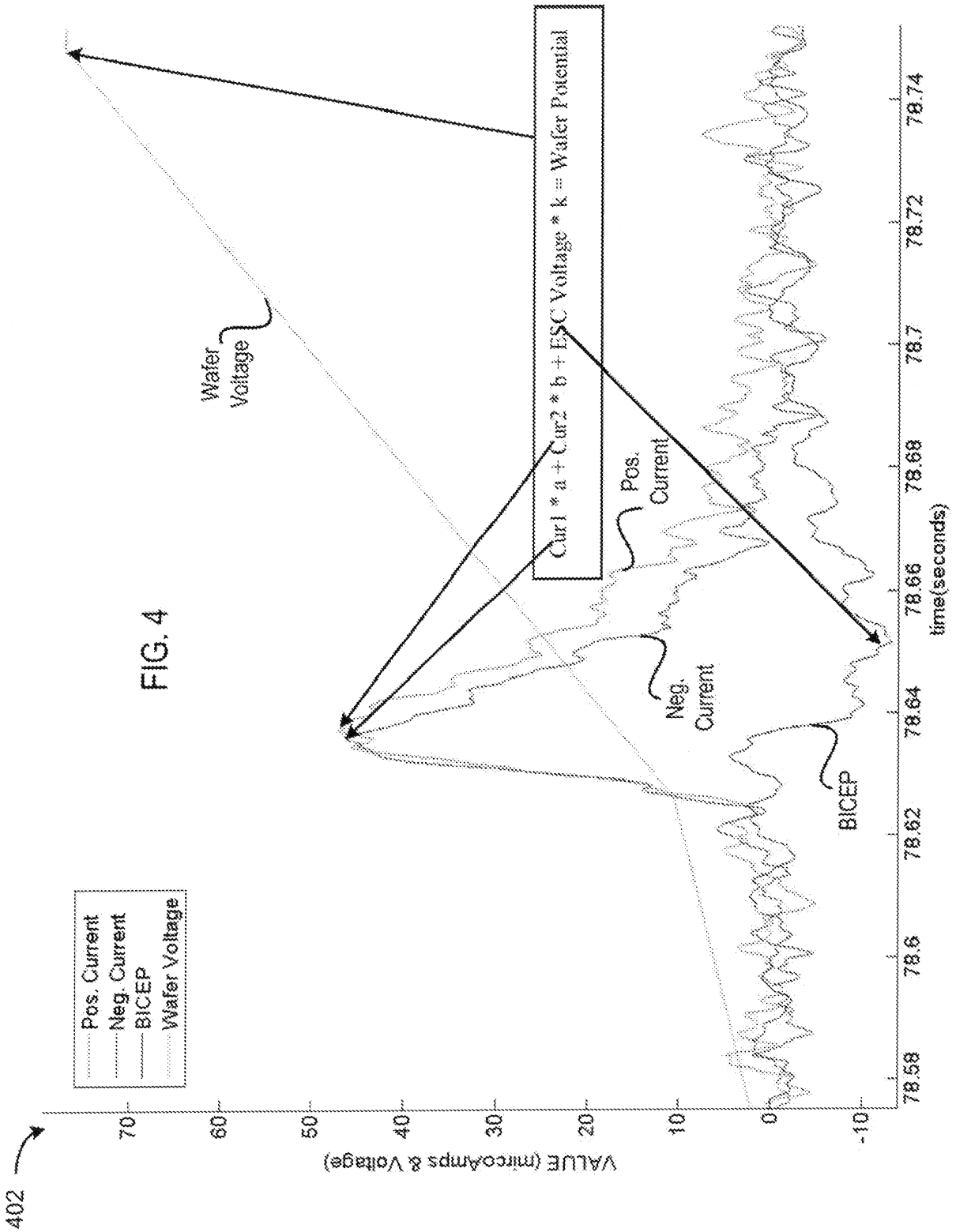
402
Pos. Current
Neg. Current
BICEP
Wafer Voltage
VALUE (microAmps & Voltage)
70
60
50
40
30
20
10
0
-10
78.58
78.6
78.62
78.64
78.66
78.68
78.7
78.72
78.74
time(seconds)
Wafer Voltage
Cur1 * a + Cur2 * b + ESC Voltage * k = Wafer Potential
Pos. Current
Neg. Current
BICEP

FIG. 4

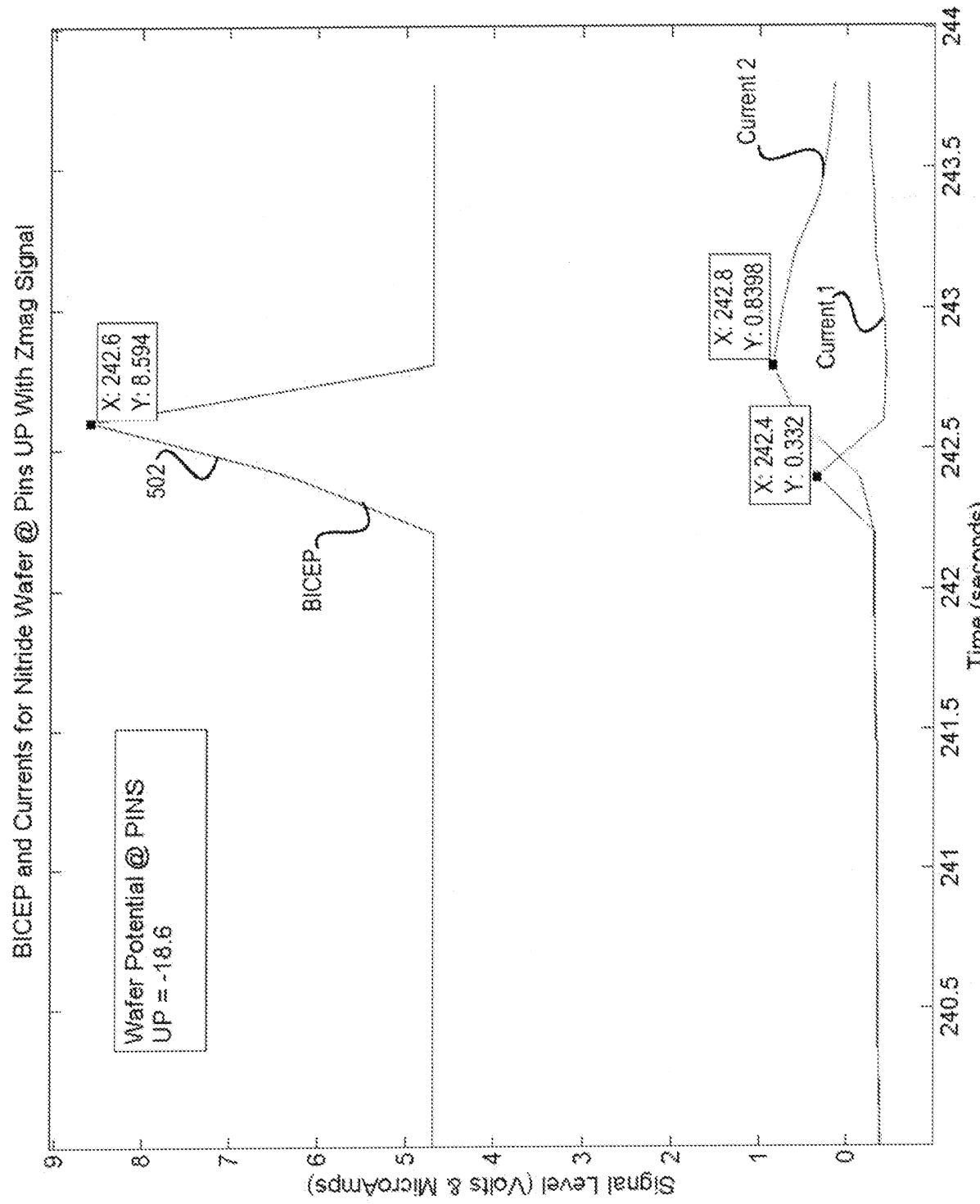
BICEP and Currents for Nitride Wafer @ Pins UP With Zmag Signal
Wafer Potential @ PINS
UP = -18.6
X: 242.6
Y: 8.594
502
BICEP
X: 242.4
Y: 0.332
X: 242.8
Y: 0.8398
Current 1
Current 2
Signal Level (Volts & MicroAmps)
Time (seconds)
240.5
241
241.5
242
242.5
243
243.5
244
0
1
2
3
4
5
6
7
8
9

FIG. 5A

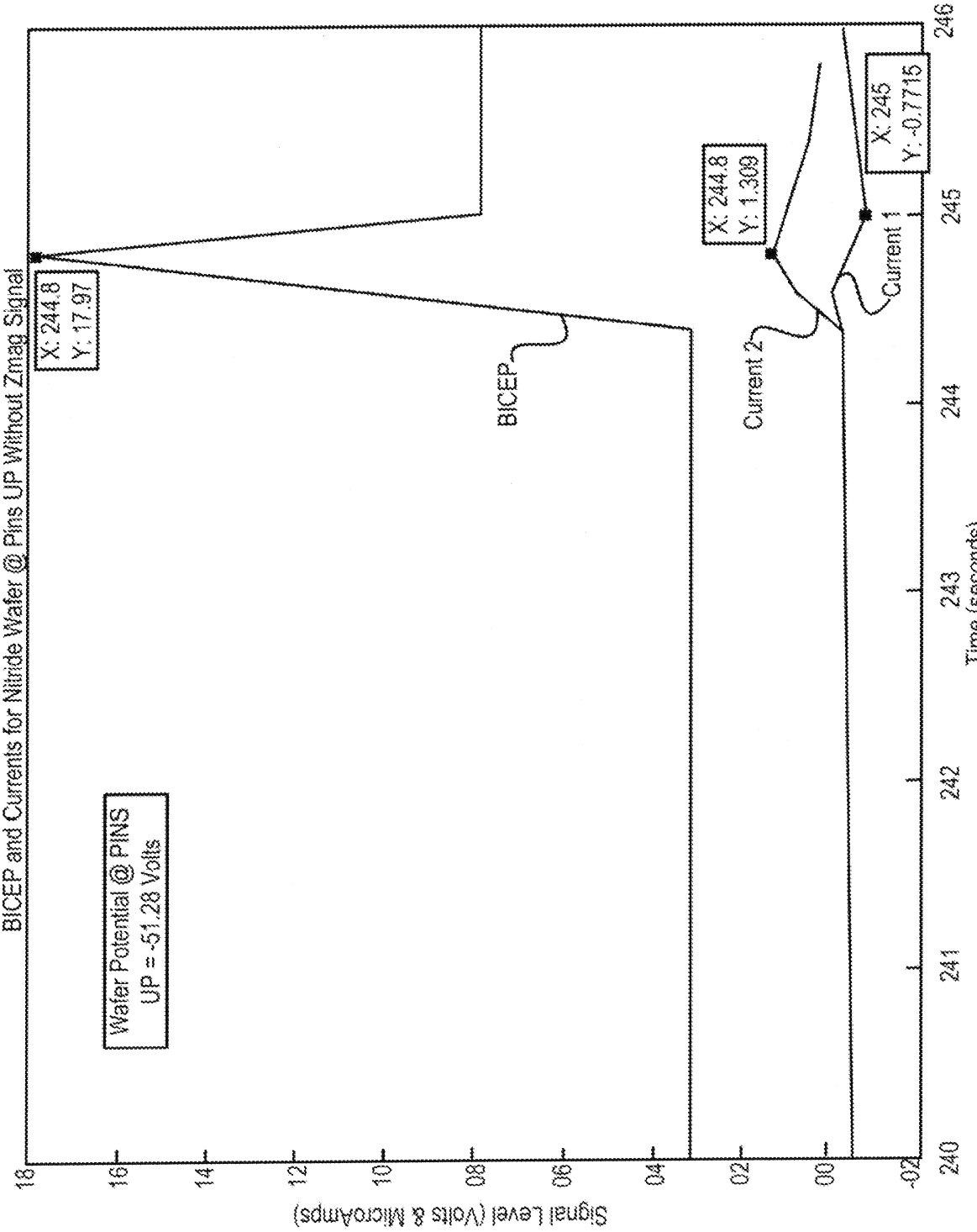
BICEP and Currents for Nitride Wafer @ Pins UP Without Zmag Signal
X: 244.8
Y: 17.97
Wafer Potential @ PINS
UP = -51.28 Volts
BICEP
Current 2
X: 244.8
Y: 1.309
Current 1
X: 245
Y: -0.7715
Signal Level (Volts & MicroAmps)
Time (seconds)
18
16
14
12
10
08
06
04
02
00
-02
240
241
242
243
244
245
246

FIG. 5B

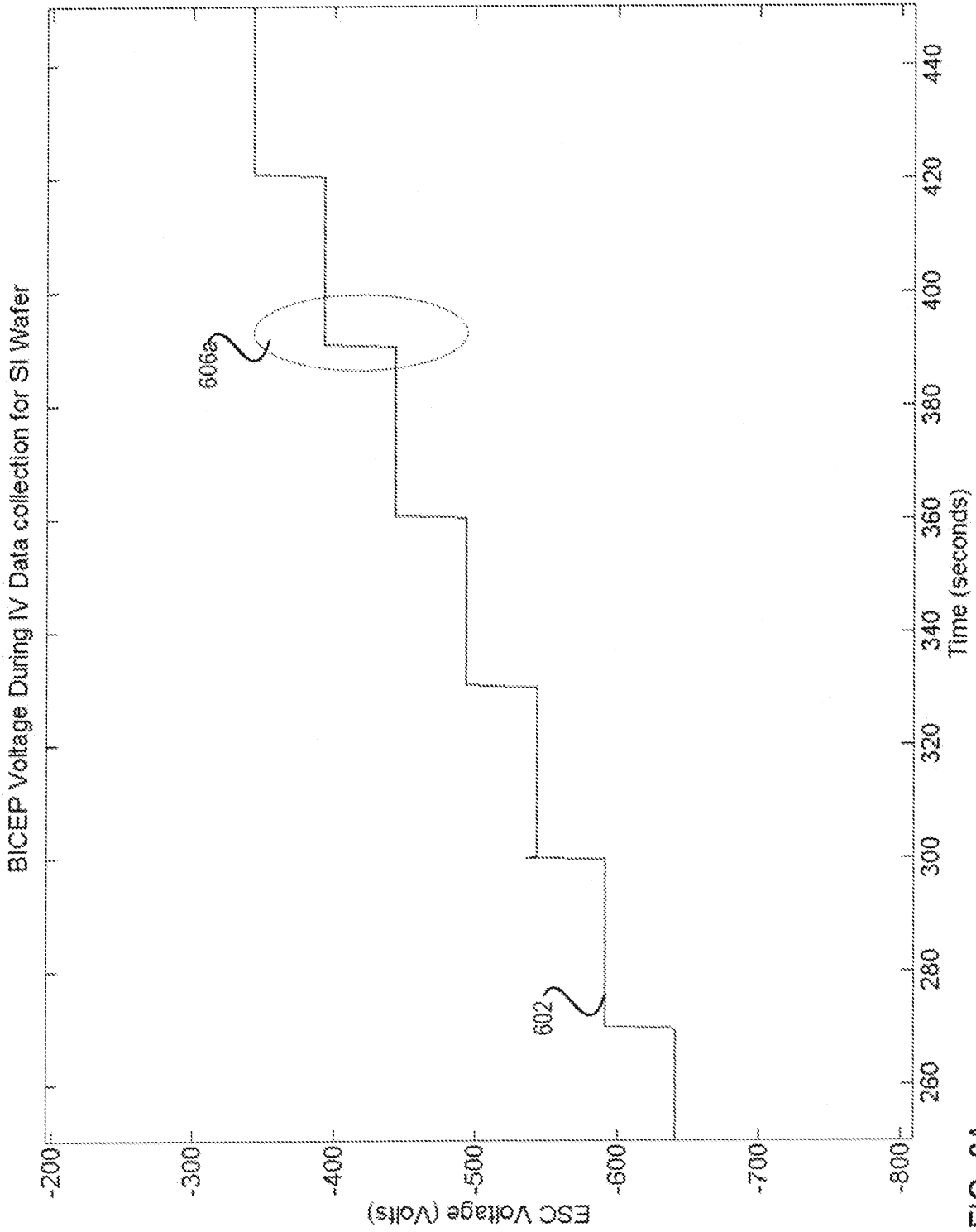
BICEP Voltage During IV Data collection for SI Wafer
ESC Voltage (Volts)
Time (seconds)
-200
-300
-400
-500
-600
-700
-800
260
280
300
320
340
360
380
400
420
440
602
606a

FIG. 6A

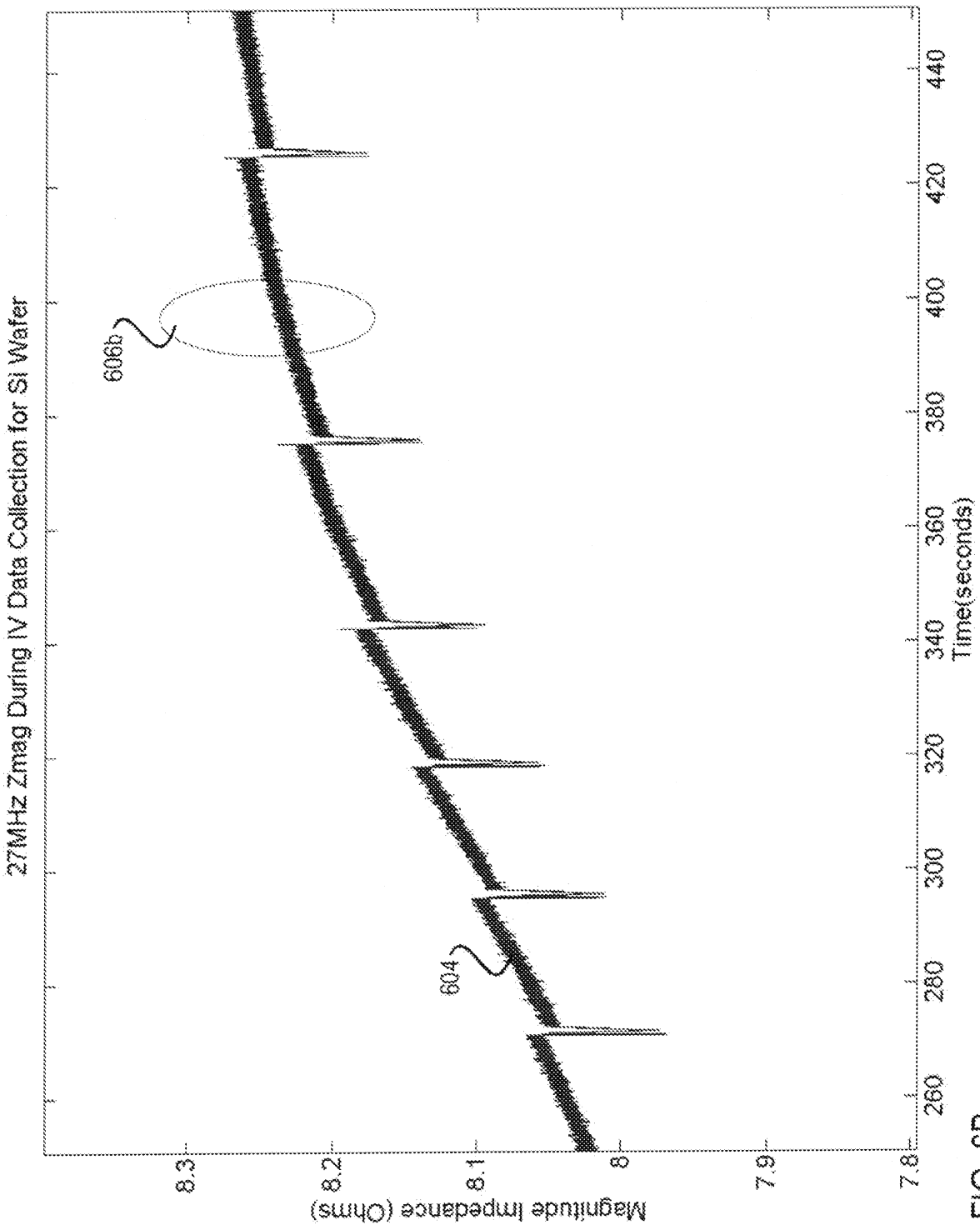
27MHz Zmag During IV Data Collection for Si Wafer
606b
604
Magnitude Impedance (Ohms)
8.3
8.2
8.1
8
7.9
7.8
260
280
300
320
340
360
380
400
420
440
Time(seconds)

FIG. 6B

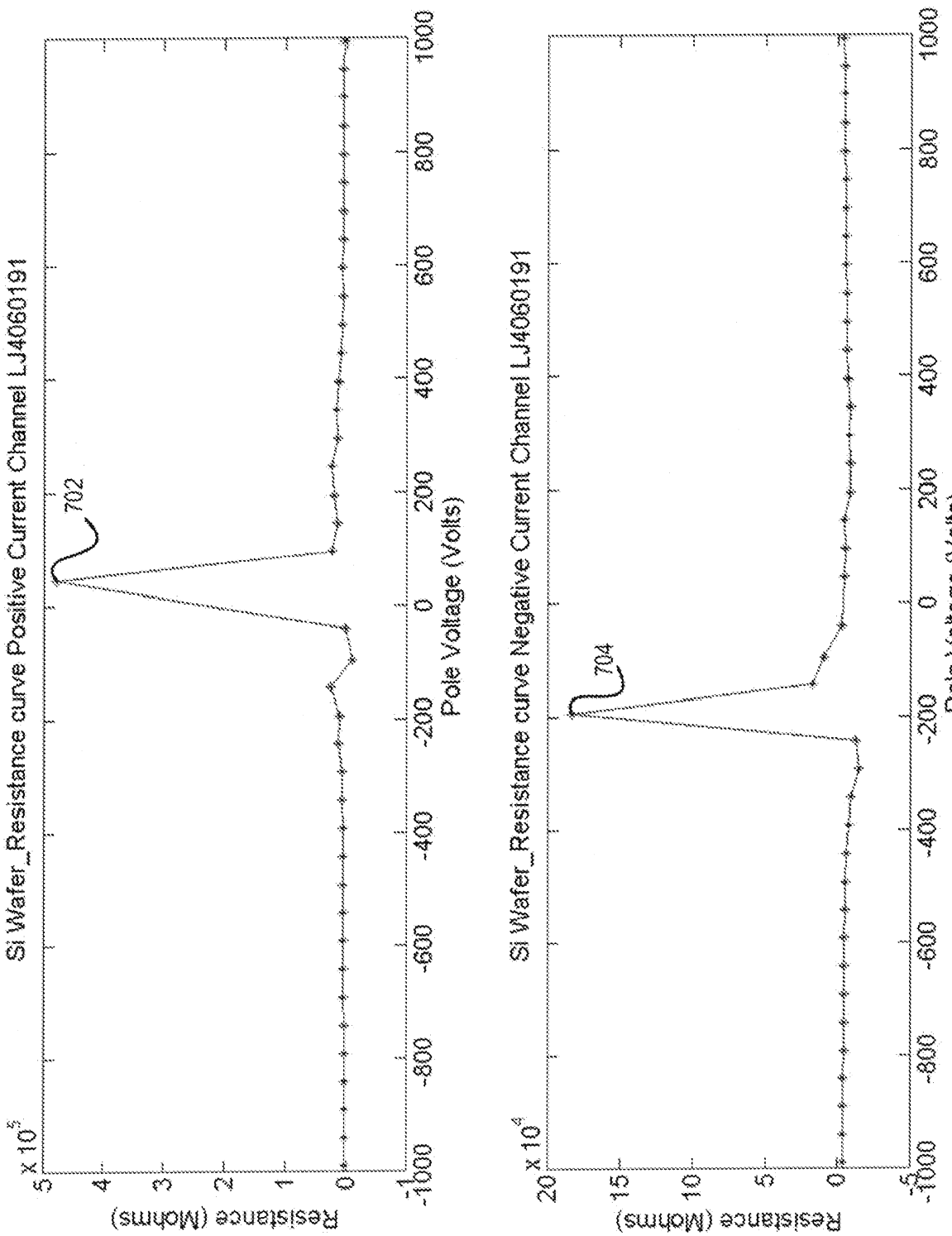
Si Wafer_Resistance curve Positive Current Channel LJ4060191
x 10^5
Resistance (Mohms)
Pole Voltage (Volts)
702
Si Wafer_Resistance curve Negative Current Channel LJ4060191
x 10^4
Resistance (Mohms)
Pole Voltage (Volts)
704

FIG. 7

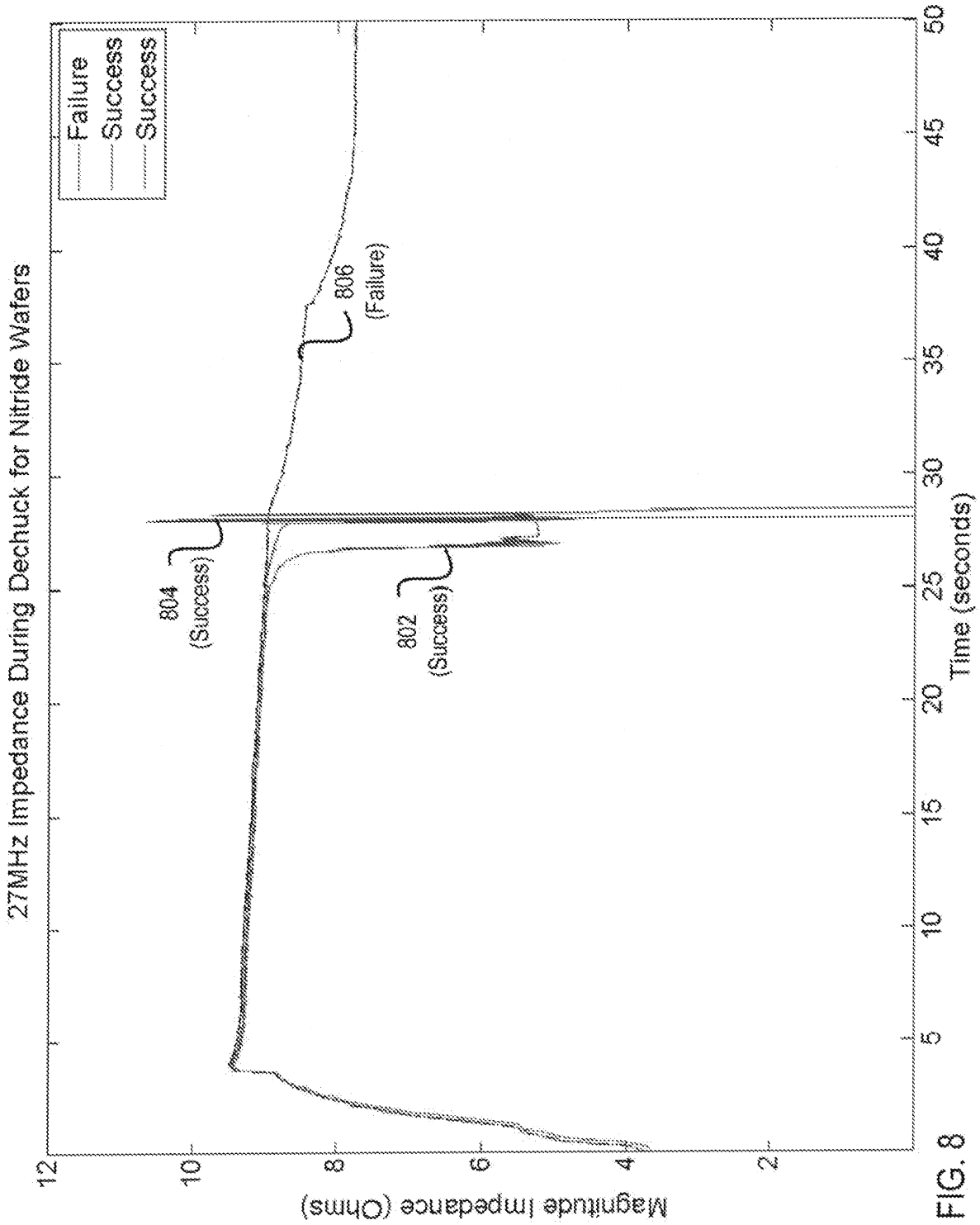
27MHz Impedance During Dechuck for Nitride Wafers
Failure
Success
Success
804
(Success)
802
(Success)
806
(Failure)
Magnitude Impedance (Ohms)
Time (seconds)
12
10
8
6
4
2
5
10
15
20
25
30
35
40
45
50

FIG. 8

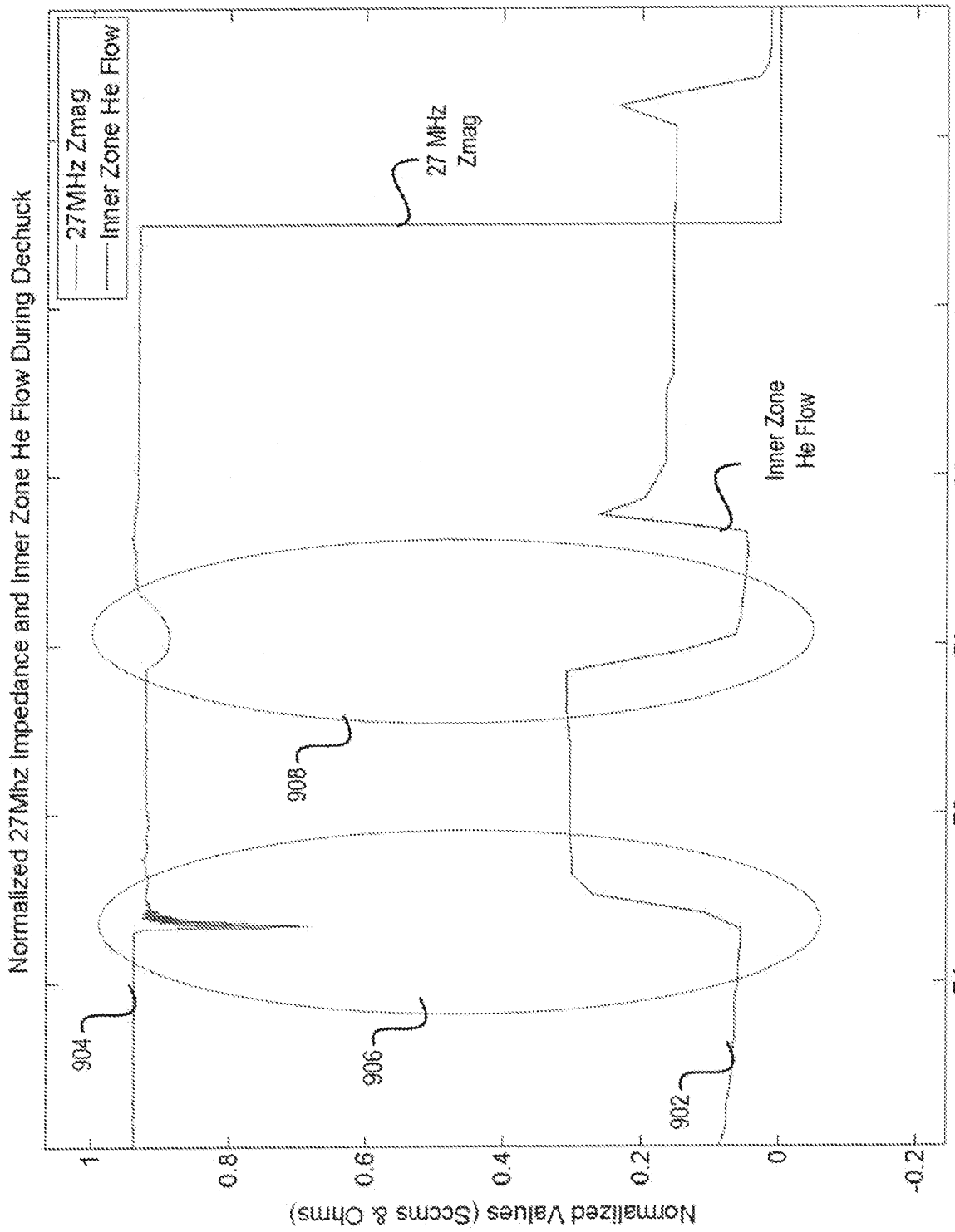
Normalized 27Mhz Impedance and Inner Zone He Flow During Dechuck
27MHz Zmag
Inner Zone He Flow
27 MHz
Zmag
Inner Zone
He Flow
904
908
906
902
Normalized Values (Sccms & Ohms)
Time (seconds)
1
0.8
0.6
0.4
0.2
0
-0.2
74
76
78
80
82
84

FIG. 9