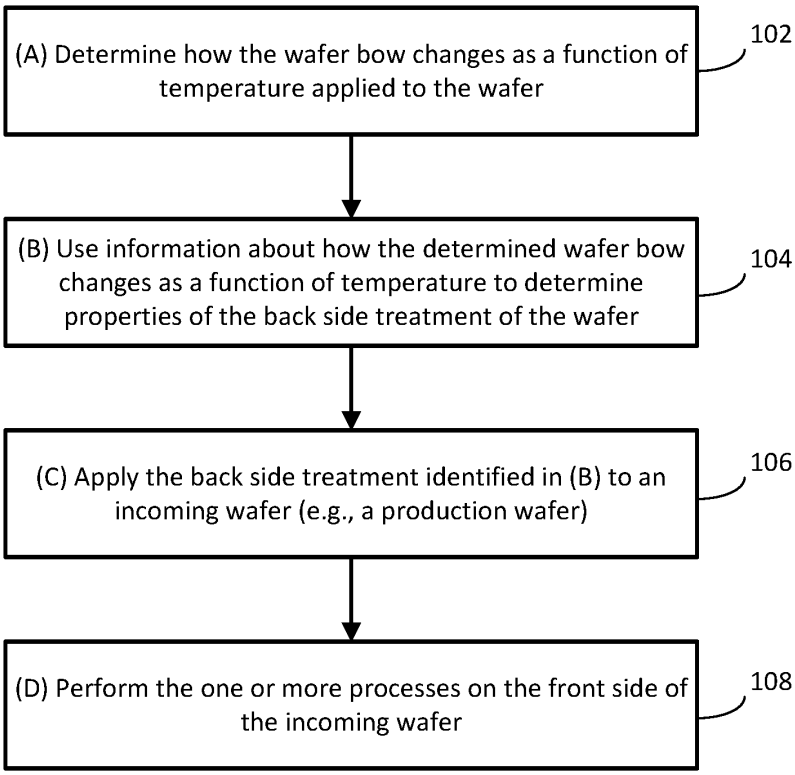
(A) Determine how the wafer bow changes as a function of temperature applied to the wafer
102
(B) Use information about how the determined wafer bow changes as a function of temperature to determine properties of the back side treatment of the wafer
104
(C) Apply the back side treatment identified in (B) to an incoming wafer (e.g., a production wafer)
106
(D) Perform the one or more processes on the front side of the incoming wafer
108

Figure 1

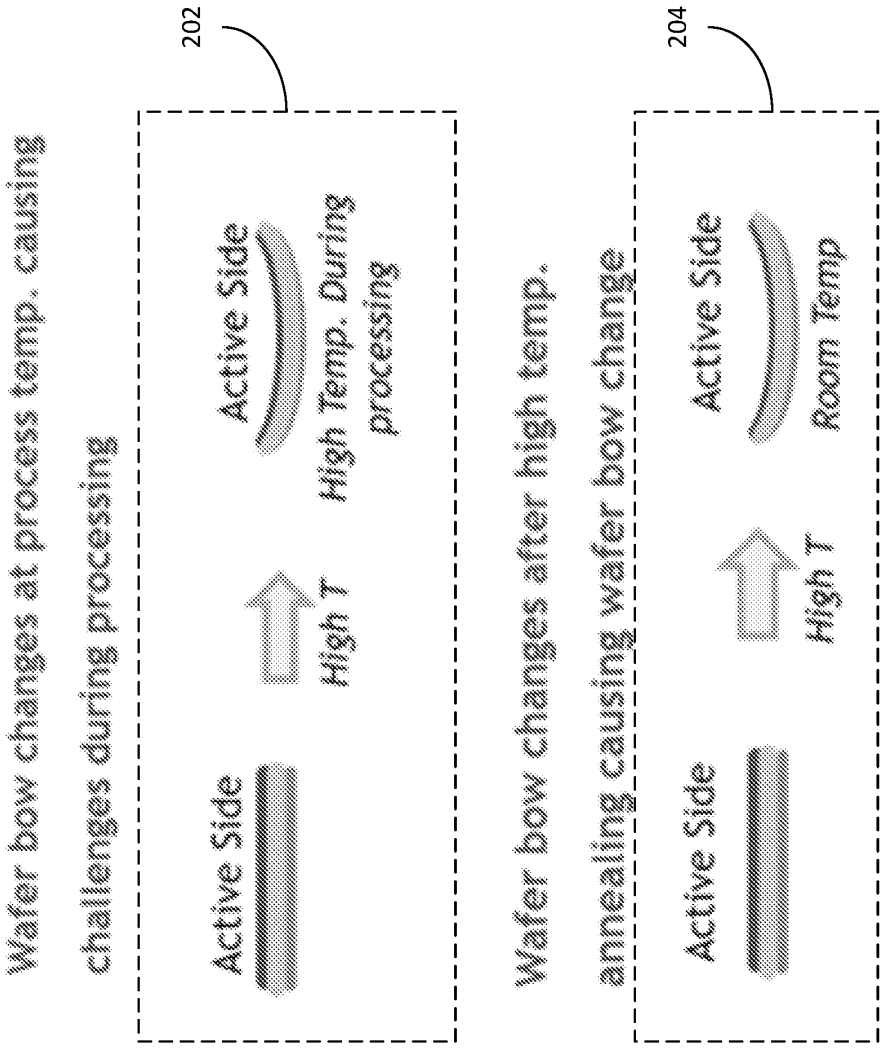
Wafer bow changes at process temp. causing challenges during processing
202
Active Side
High T
Active Side
High Temp. During processing
Wafer bow changes after high temp. annealing causing wafer bow change
204
Active Side
High T
Active Side
Room Temp

Figure 2A

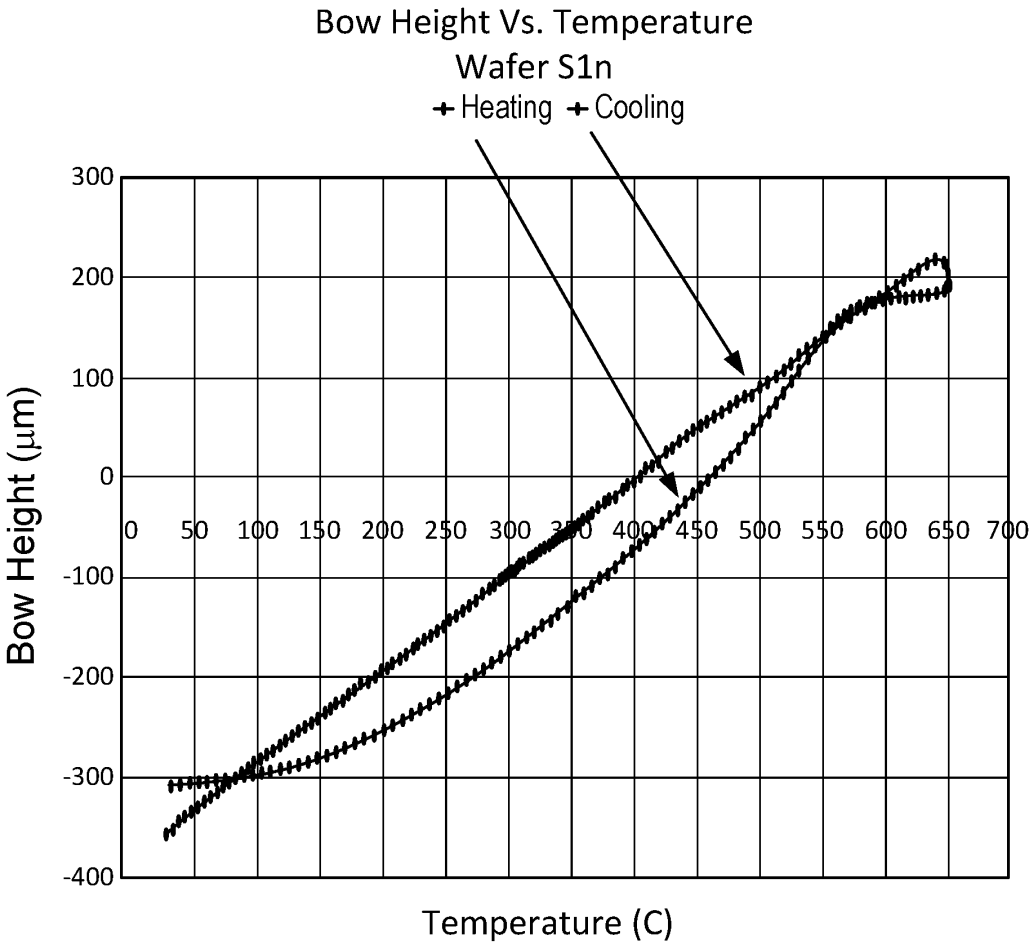
Bow Height Vs. Temperature
Wafer S1n
Heating
Cooling
Bow Height (μm)
300
200
100
0
-100
-200
-300
-400
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Temperature (C)

Figure 2B

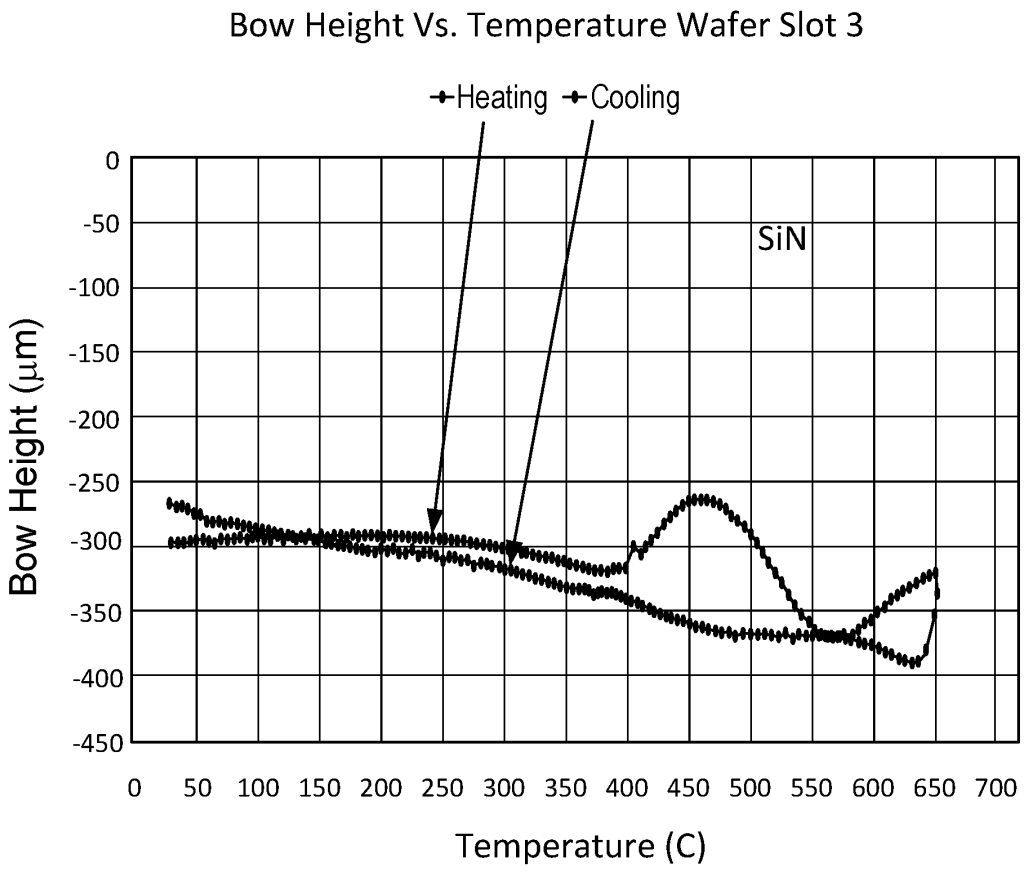
Bow Height Vs. Temperature Wafer Slot 3
Heating
Cooling
SiN
Bow Height (μm)
0
-50
-100
-150
-200
-250
-300
-350
-400
-450
0 50 100 150 200 250 300 350 400 450 500 550 600 650 700
Temperature (C)

Figure 2C

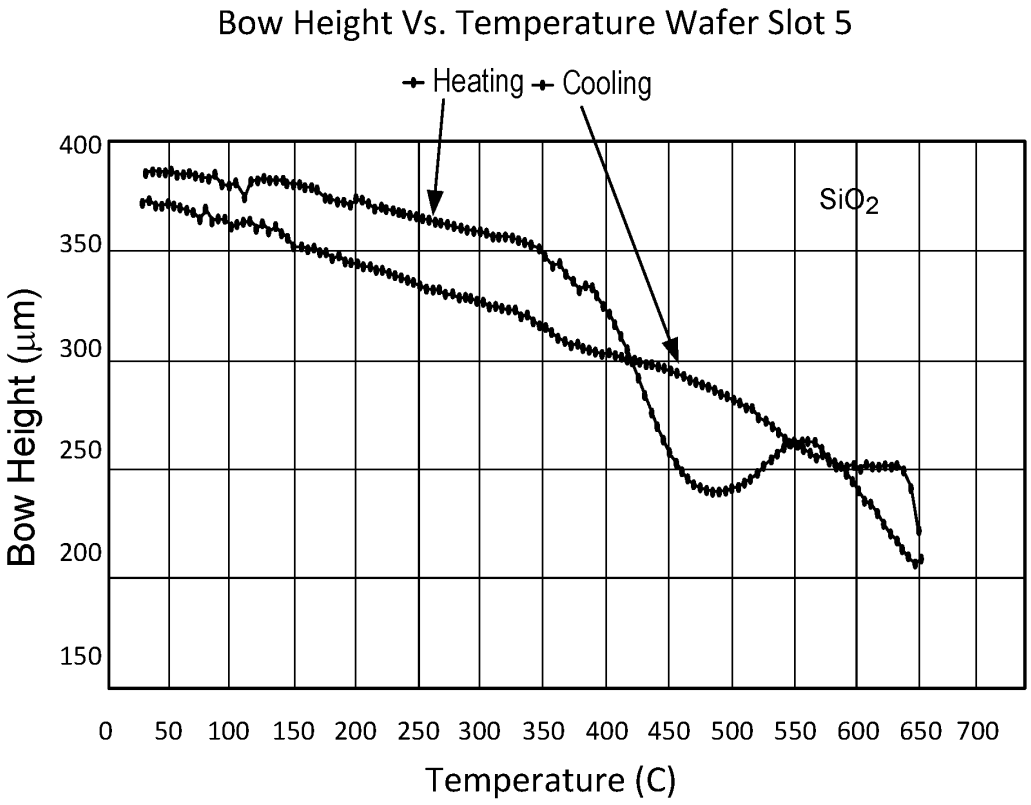
Bow Height Vs. Temperature Wafer Slot 5
Heating
Cooling
SiO_2
Bow Height (µm)
400
350
300
250
200
150
0 50 100 150 200 250 300 350 400 450 500 550 600 650 700
Temperature (C)

Figure 2D

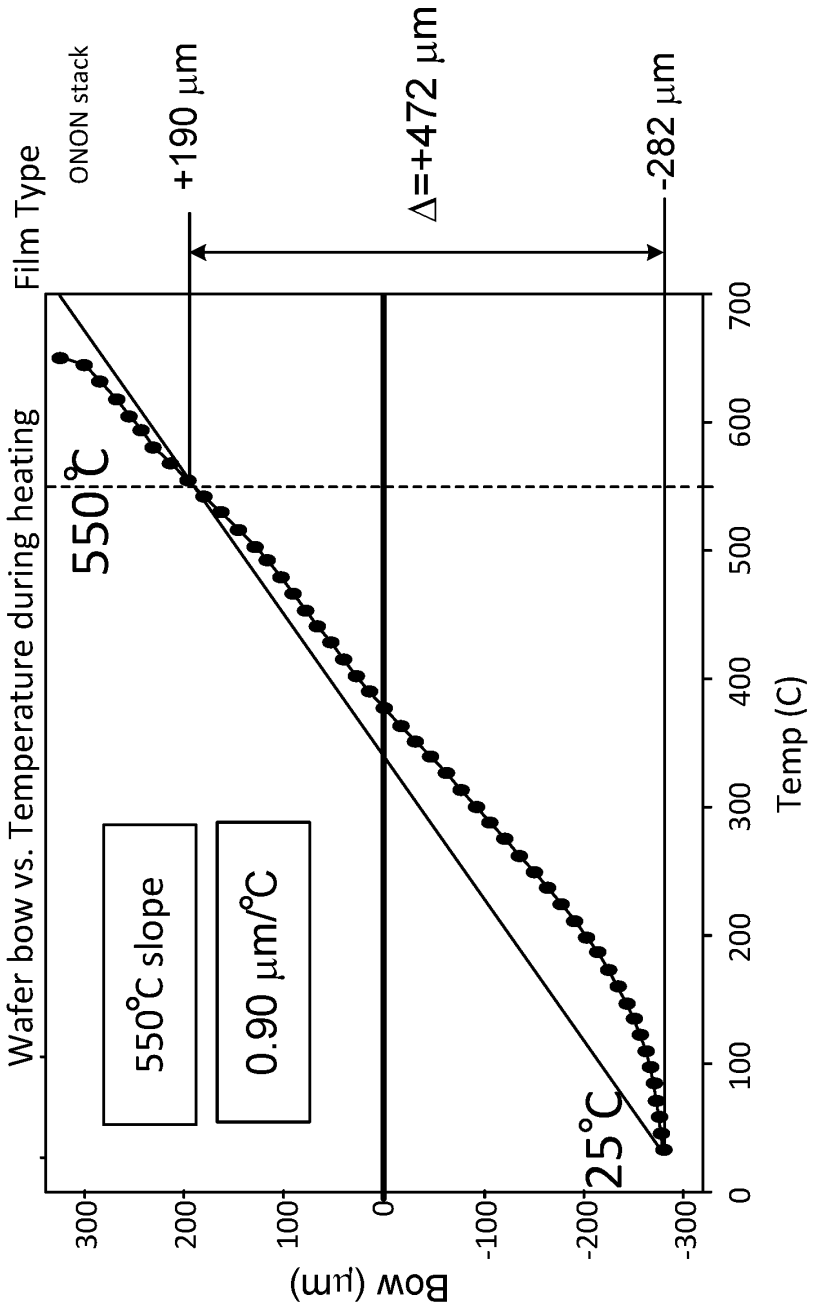
Wafer bow vs. Temperature during heating
Film Type
ONON stack
+190 µm
Δ=+472 µm
-282 µm
550°C
25°C
550°C slope
0.90 µm/°C
Bow (µm)
Temp (C)
300
200
100
0
-100
-200
-300
0
100
200
300
400
500
600
700

Figure 3

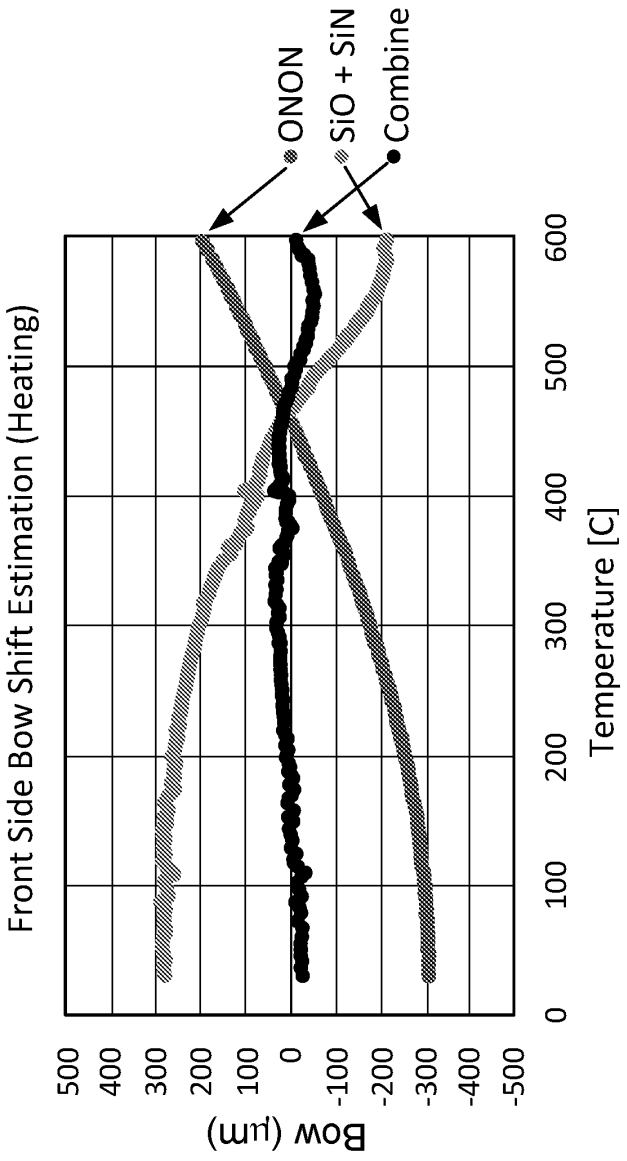
Front Side Bow Shift Estimation (Heating)
ONON
SiO + SiN
Combine
Bow (μm)
500
400
300
200
100
0
-100
-200
-300
-400
-500
0
100
200
300
400
500
600
Temperature [C]

Figure 4

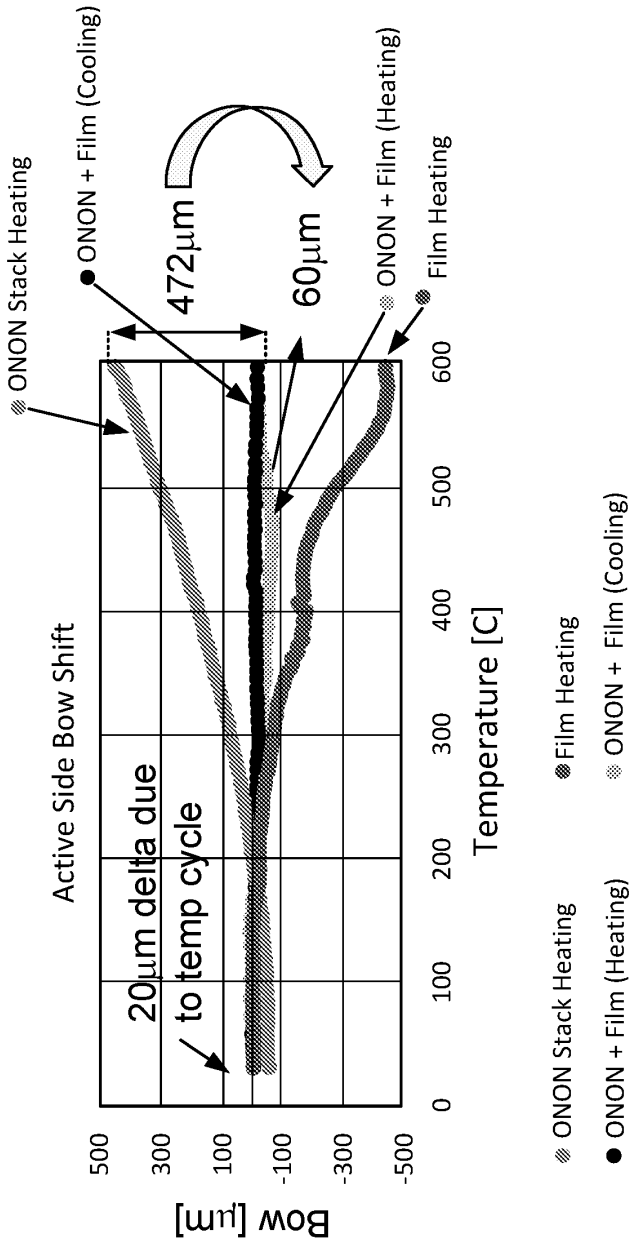
ONON Stack Heating
ONON + Film (Cooling)
472µm
60µm
ONON + Film (Heating)
Film Heating
Active Side Bow Shift
20µm delta due
to temp cycle
Bow [µm]
500
300
100
-100
-300
-500
0
100
200
300
400
500
600
Temperature [C]
ONON Stack Heating
Film Heating
ONON + Film (Heating)
ONON + Film (Cooling)

Figure 5

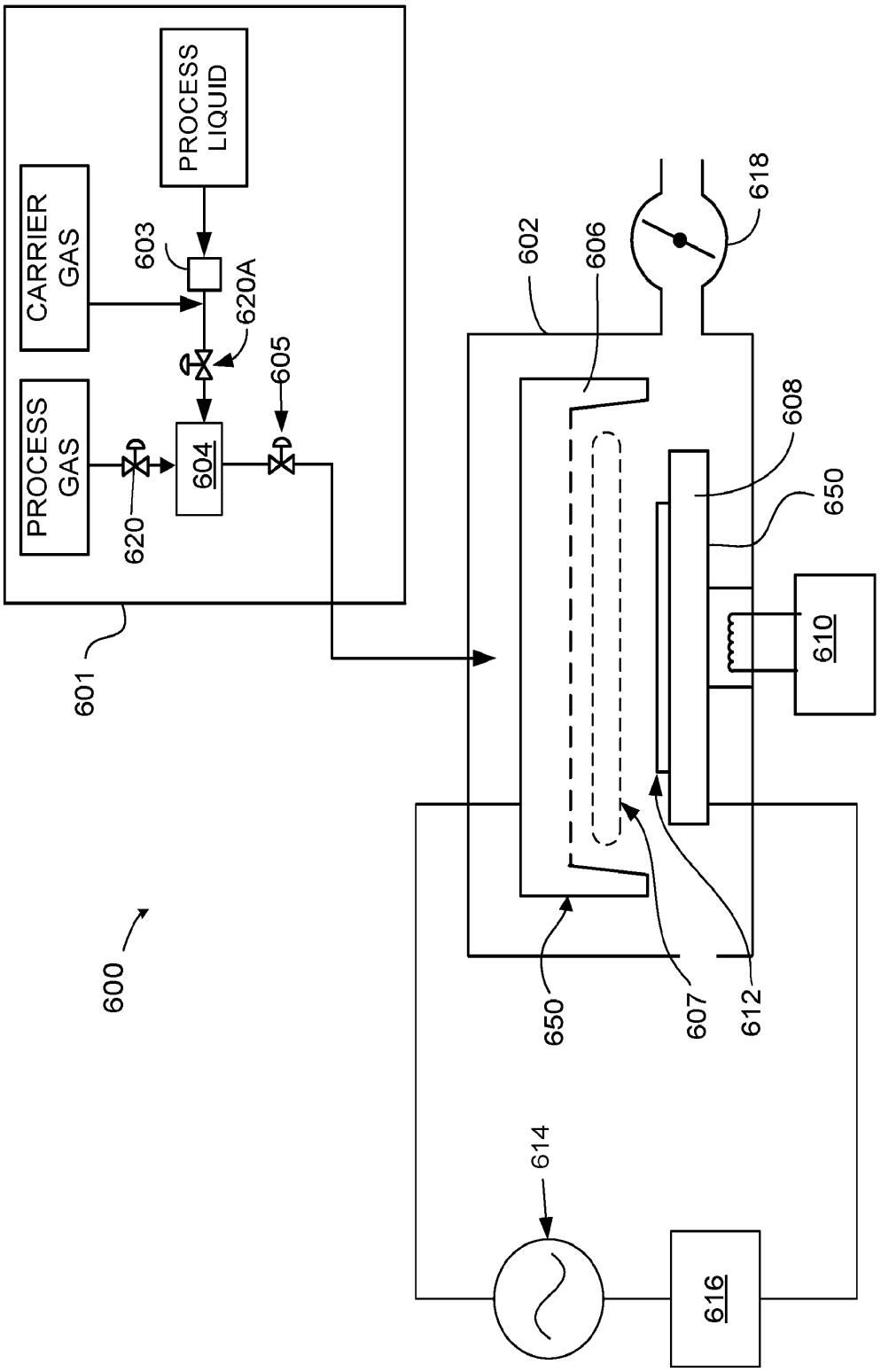
PROCESS LIQUID
CARRIER GAS
PROCESS GAS
603
620A
605
620
604
601
600
602
606
618
608
650
610
650
607
612
614
616

Figure 6

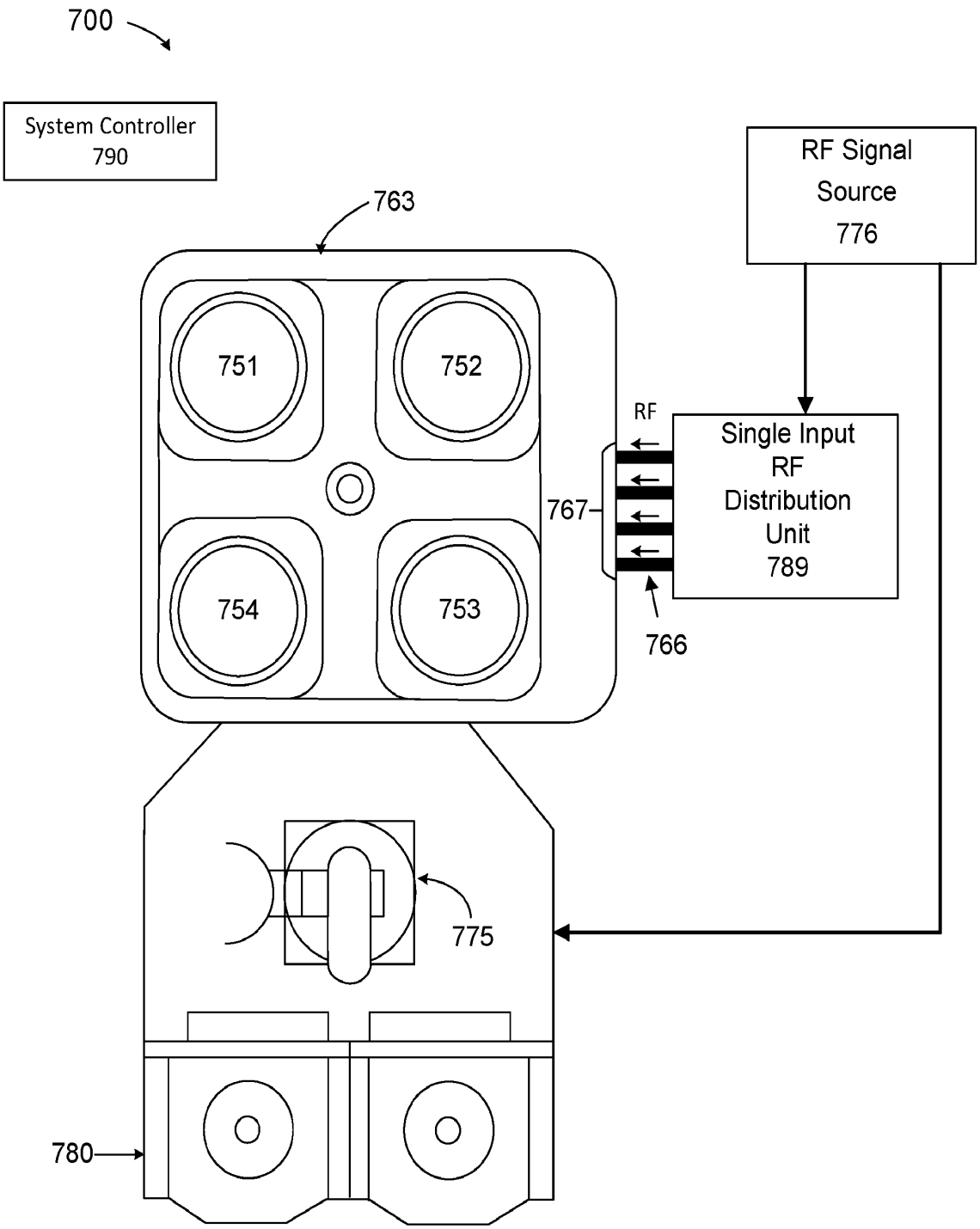
700
System Controller
790
RF Signal
Source
776
763
751
752
754
753
RF
767
Single Input
RF
Distribution
Unit
789
766
775
780

Figure 7