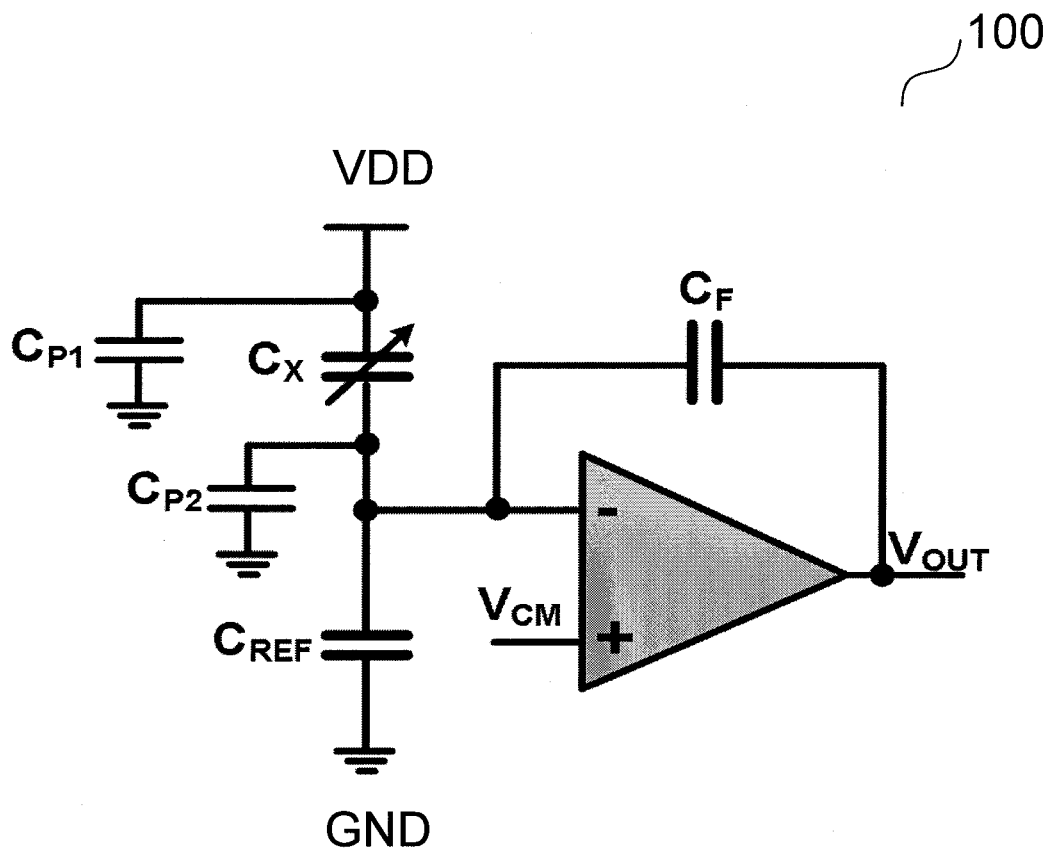
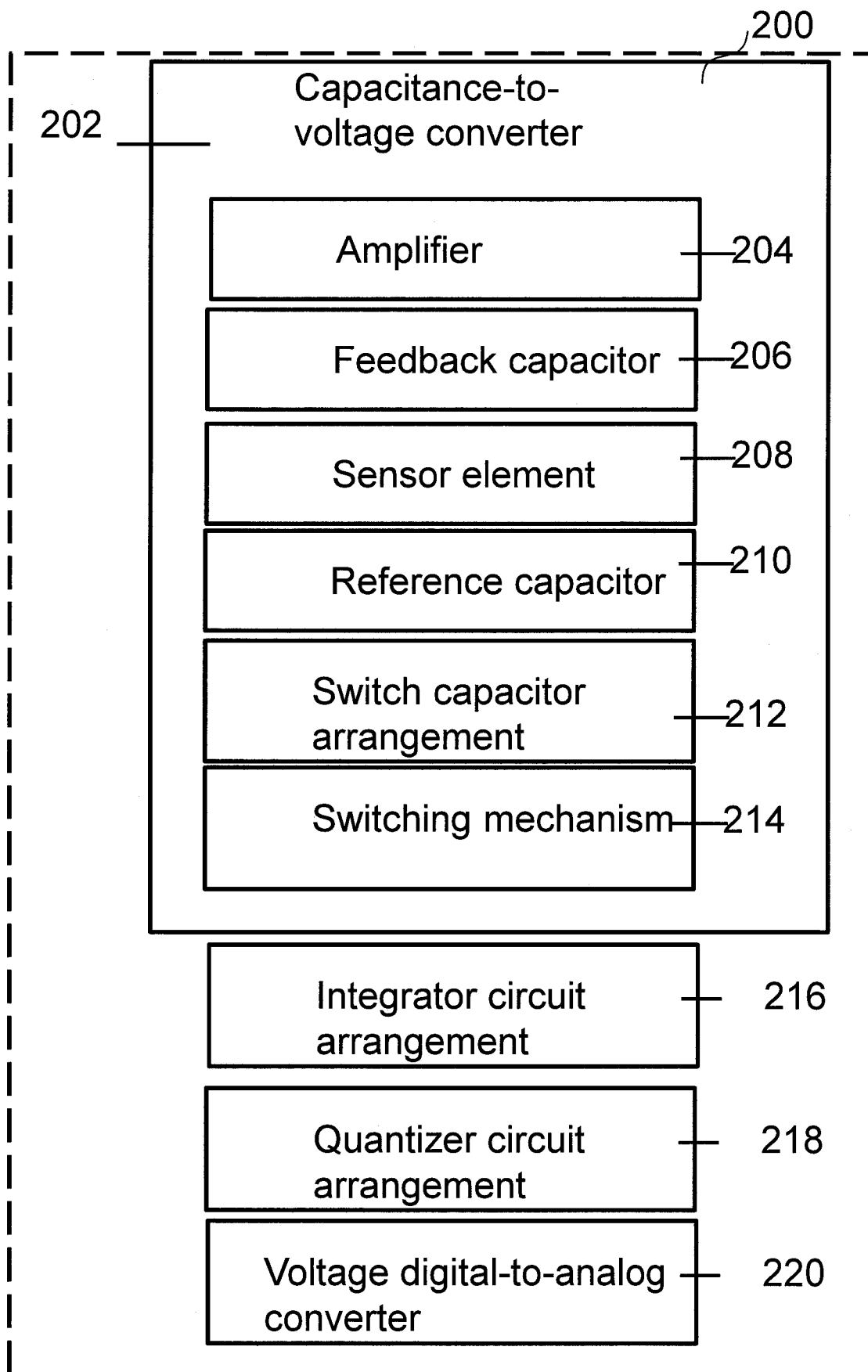
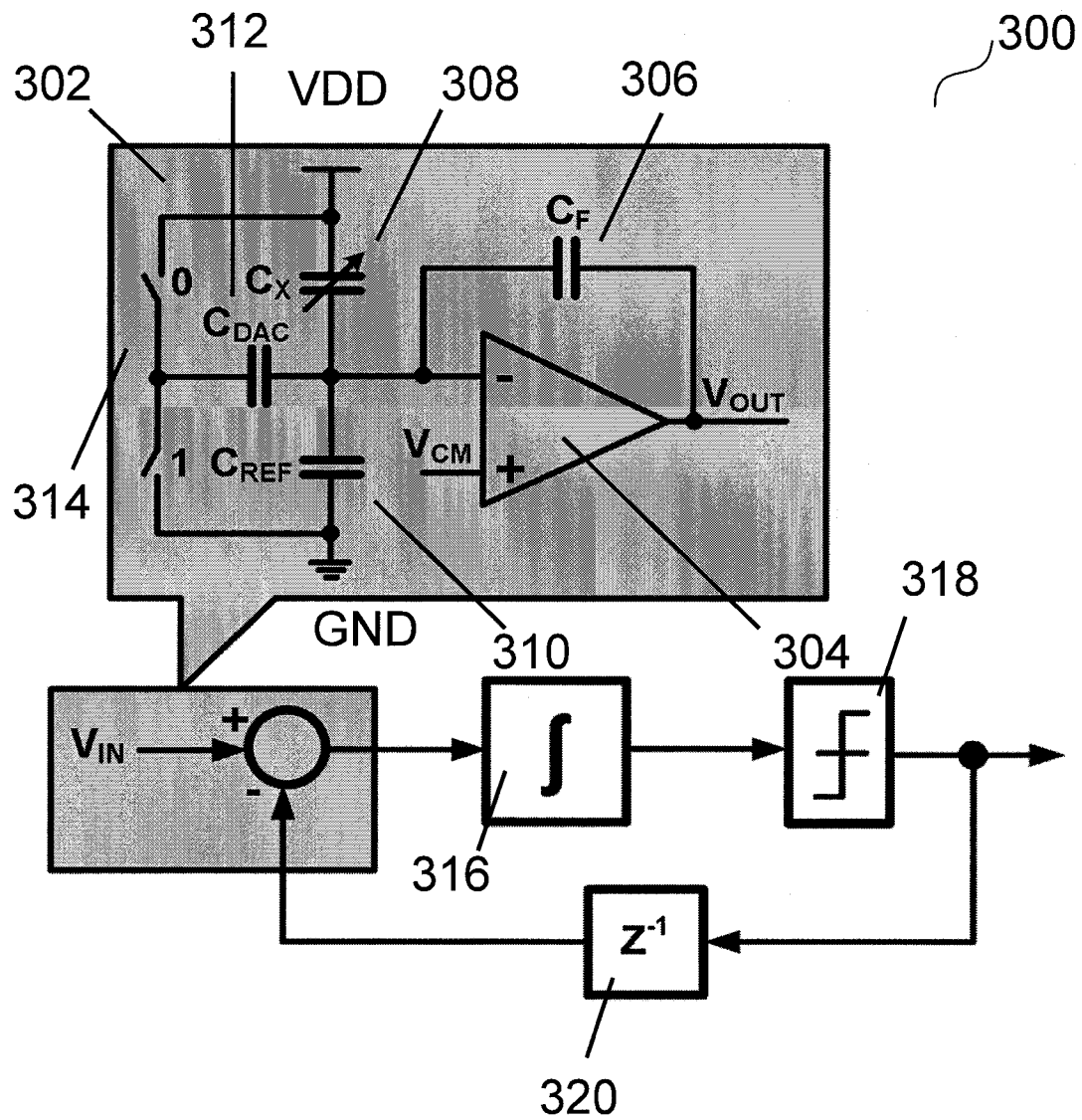
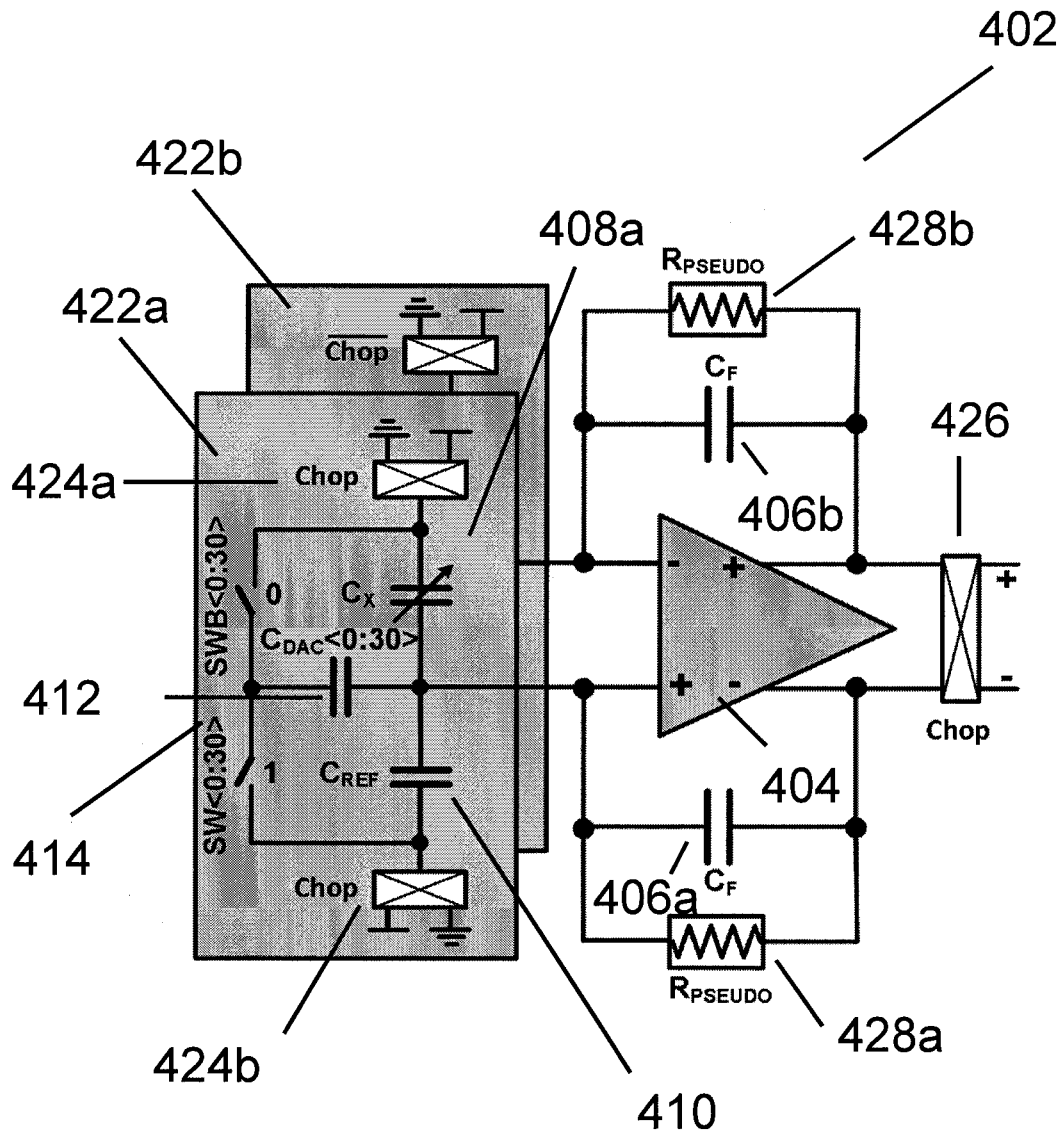


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FIG. 1

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FIG. 2

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FIG. 3

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FIG. 4A



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FIG. 4B

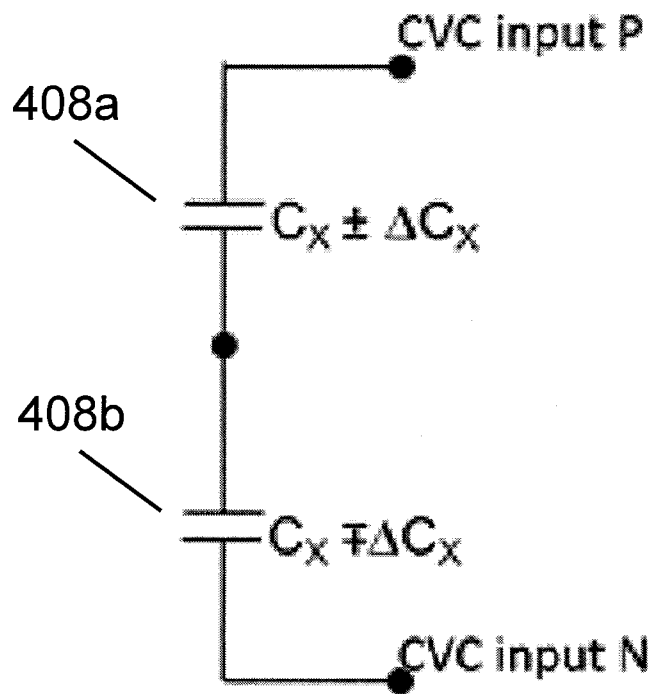
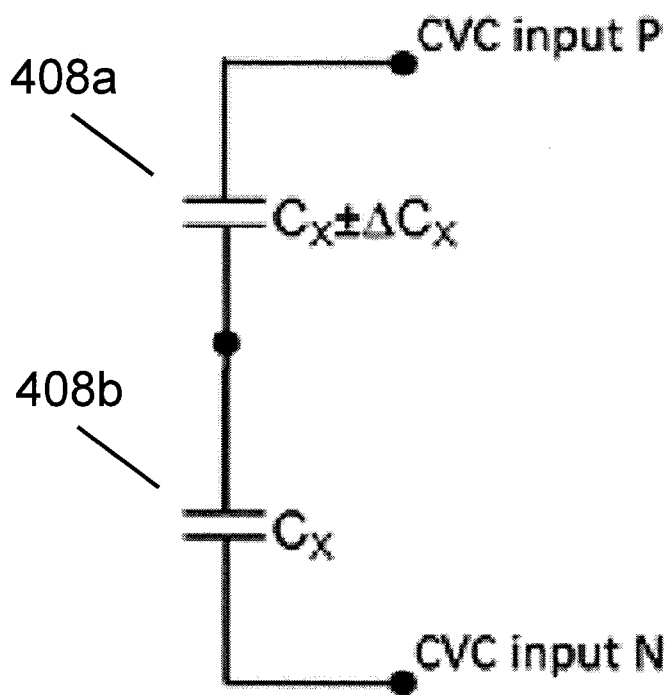
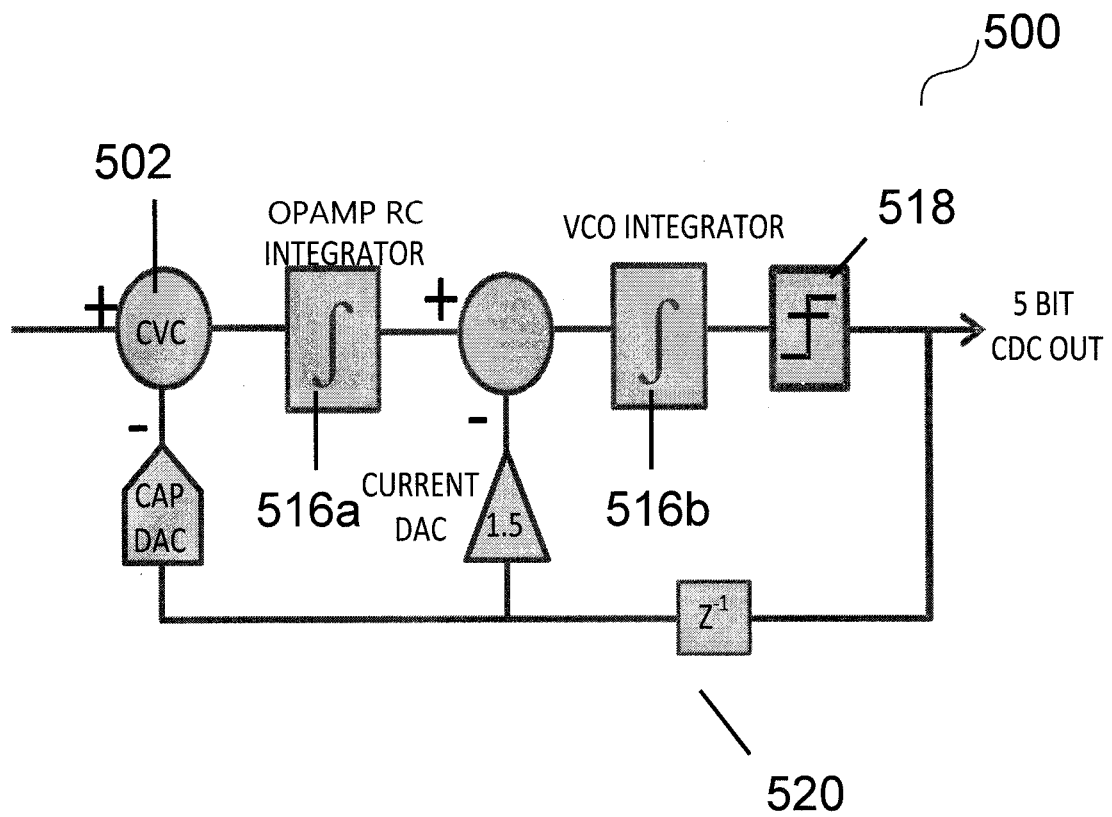
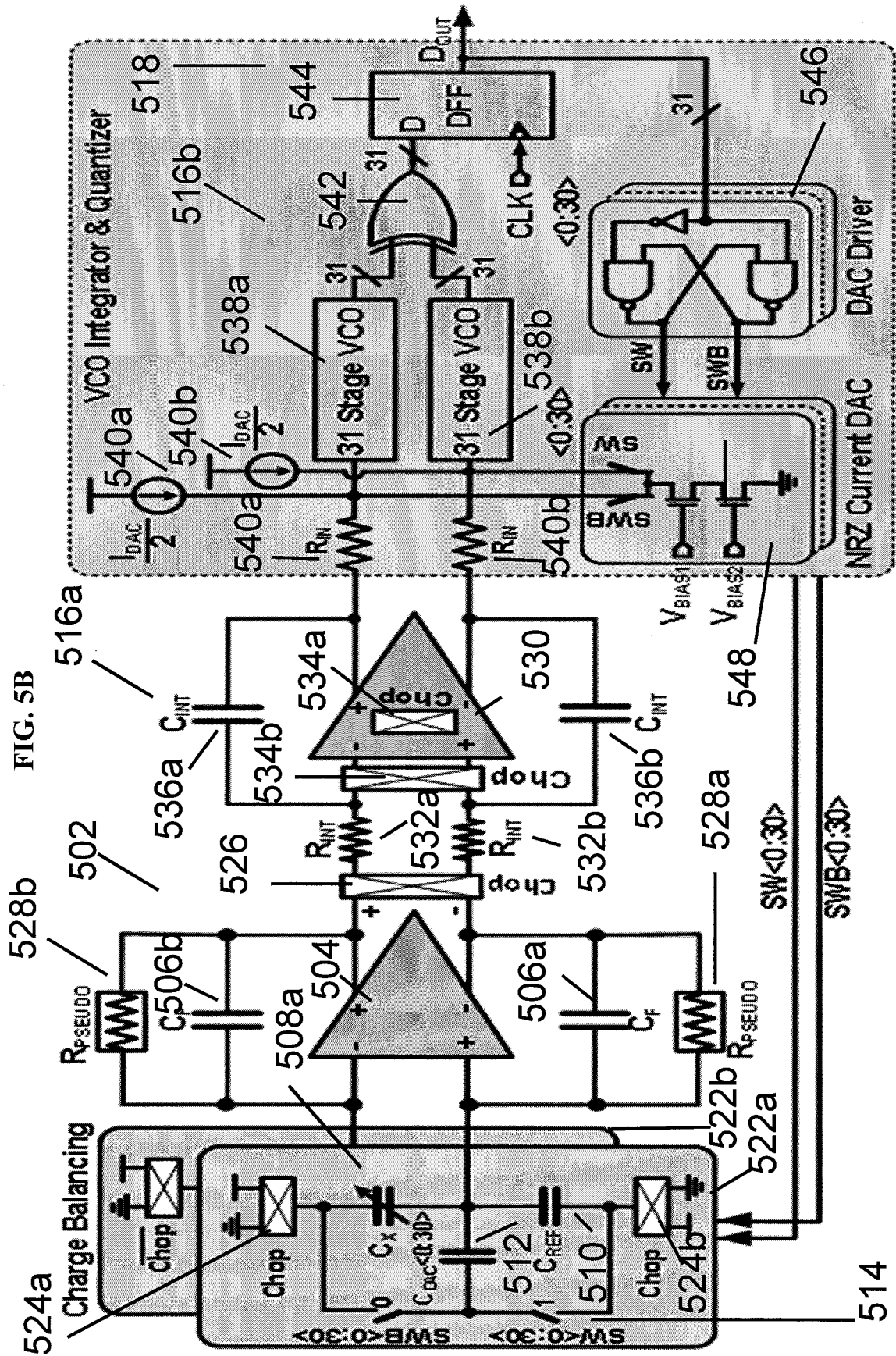


FIG. 4C



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FIG. 5A



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FIG. 5C

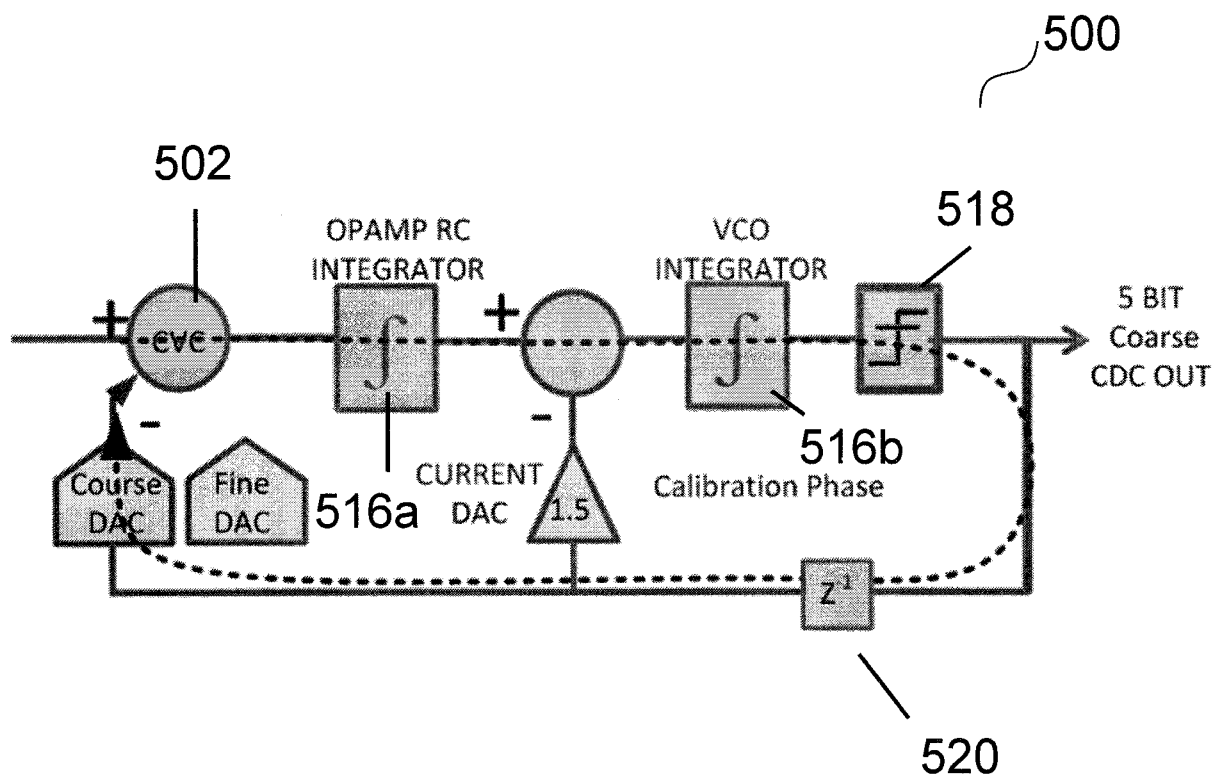
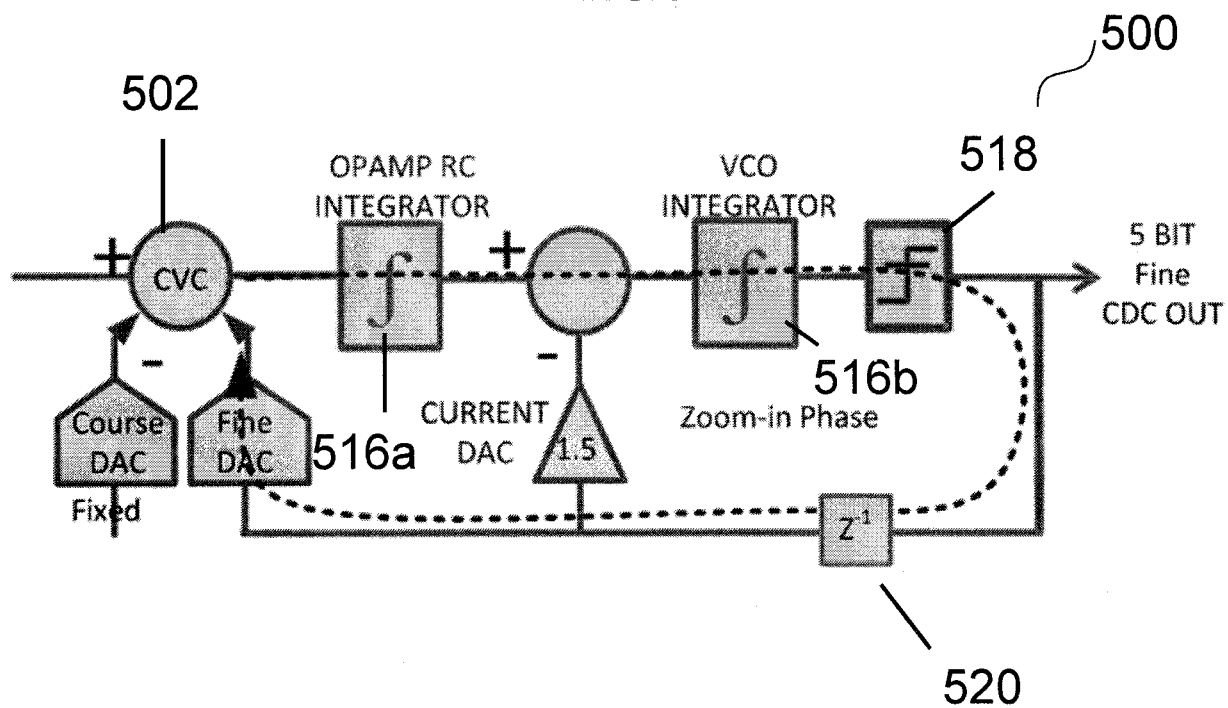
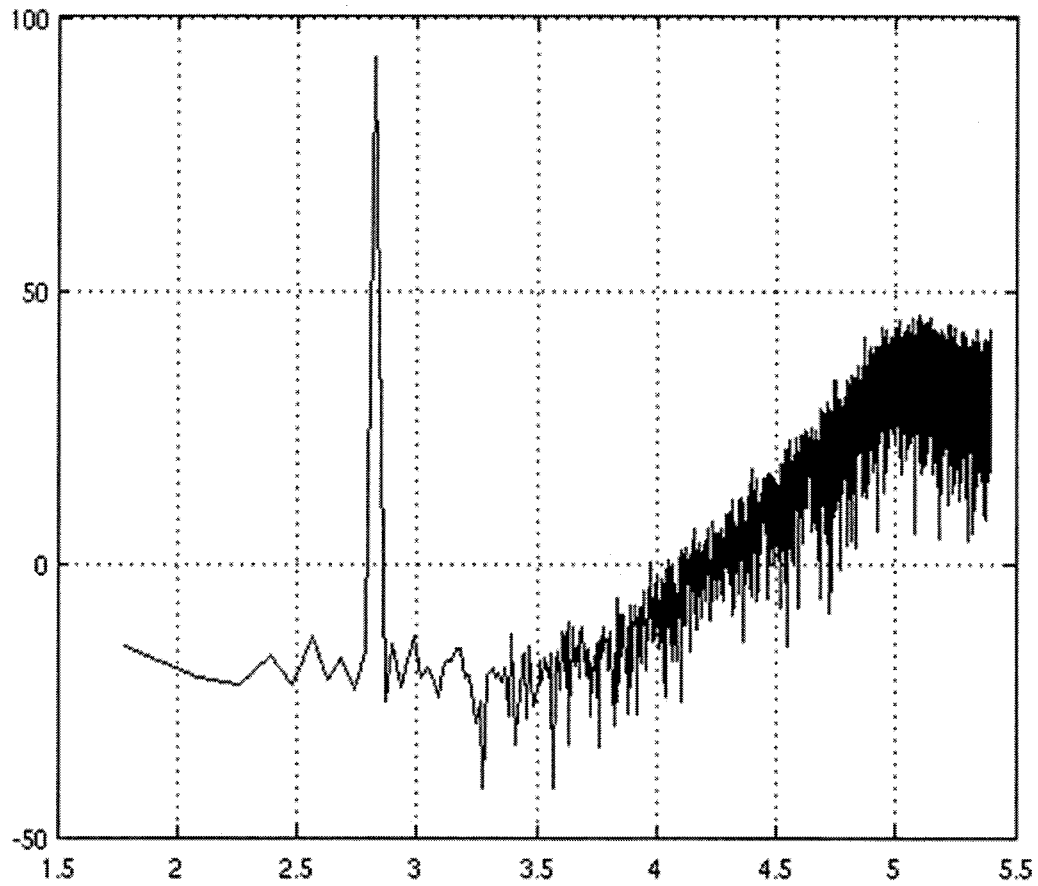


FIG. 5D



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FIG. 6600SNDR
113dB

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FIG. 7700

convert a sensed continuous-in-time
applied capacitance signal to a delta
analog output voltage signal using a
capacitance-to-voltage converter

702

generate an analog output voltage
signal based on the delta analog output
voltage signal using an integrator circuit
arrangement

704

generate the digital output signal based
on the analog output voltage signal
using a quantizer circuit arrangement

706

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FIG. 8A800a

Parameter	Proposed modulator	[1]	[2]	[3]	[4]	[5]
Year/Publication	2016	2015/ISS CC	2014/VLS IC	2015/ISS CC	2013/JSS CC	2012/ISS CC
Description	CT $\Delta\Sigma$ M	Iterative delay line discharge	2nd order DT- $\Delta\Sigma$ + SAR	Period Modulation	3rd order DT- $\Delta\Sigma$	3rd order DT- $\Delta\Sigma$
Process/Technology	0.18um	40nm	0.18um	0.16um	0.16um	0.35um
Input range	0-10pF	0.7pF-10nF	0-24pF	0-8pF	0.54-1.06pF	NA
Resolution (aF)	215	12300	160aF	255	75aF	65aF
ENOB	14	9	15.4	13.1	12.5	17.2
Measurement Time	125us	19us	230us	6.86ms	800uS	20us
Power	48uW	1.84uW	33.7uW	14uW	10.3uW	15mW
Figure of Merit (FoM) (fJ/Conv)	440	141	175	10600	3900	5515
FoM (Schreier) (dB)	178.26	170.5	185.57	160.8	167.85	180

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FIG. 8B

800b

Key Parameters	Proposed	Michigan	Delft	Michigan	Kaust
Year	2015	2015	2013	2014	2014
Product/Publication	NA	ISSCC 2015	JSSC 2013	VLSI 2014	CICC 2014
Description	Continuous time Sigma delta with VCO quantizer	Iterative delay line discharge	SC Sigma delta	SC Sigma delta + SAR	SAR
Process Technology	0.18um	40nm	0.16um	0.18um	0.35um
Input range	0-10pF	0.7 pF – 10nF	0.54-1.06pF	0-24pF	16p
Resolution	100aF	12.3fF	75aF	160aF	NR
ENOB	15	9	12.5	15.4	12.5
Measurement Time	0.125mS	19.06uS	0.8mS	0.23mS	0.65m
Power	48uW*	1.84uW	10.3uW	33.7uW	300u
FOM (pJ/CS)	0.183*	0.141	3.9	0.175	34