A Switched-Capacitor Amplifier for Use in a 2.5bit/stage Pipelined Analog-to-Digital Converter

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***Abstract*—A switched-capacitor amplifier with a nominal gain of 4 was designed for use in a 2.5 bit/stage pipelined analog-to-digital converter (ADC). The total resolution of the ADC was 10 bits. The sample rate of the ADC was $5kS/s$. The amplifier consisted of 4 sample capacitors and 1 hold capacitor in feedback around an operational transconductance amplifier (OTA). The OTA consisted of a pMOS-input folded cascode stage followed by an nMOS common source stage. The open loop DC gain of the OTA was $110.9dB$. The unity gain bandwidth of the OTA was $87.1kHz$. The circuit consumed MAKE THIS MORE ACCURATE $725nW$ of DC power. SOMETHING ABOUT EFFECTIVE NUMBER OF BITS. SOMETHING ABOUT FIGURE OF MERIT.**

***Index Terms*—switched-capacitor amplifier, pipelined analog-to-digital converter**

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transistor area
resistor area
capacitor area
total area

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TABLE I
PASSIVE COMPONENT VALUES

Component	Value
Resistors	Ω
Capacitors	F

TABLE II
TRANSISTOR SIZINGS

Transistor	Width (m)	Length (m)	Aspect Ratio

TABLE III
SUMMARY OF SPECIFICATIONS AND RESULTS

Specification	Specification Value	FF Result	TT Result	SS Result
Open Loop OTA DC Gain				
Open Loop OTA Phase Margin				
Open Loop OTA $3dB$ Bandwidth				
Open Loop OTA Unity Gain Bandwidth				
Overall Power Consumption				
Overall Figure of Merit				
Overall Area				

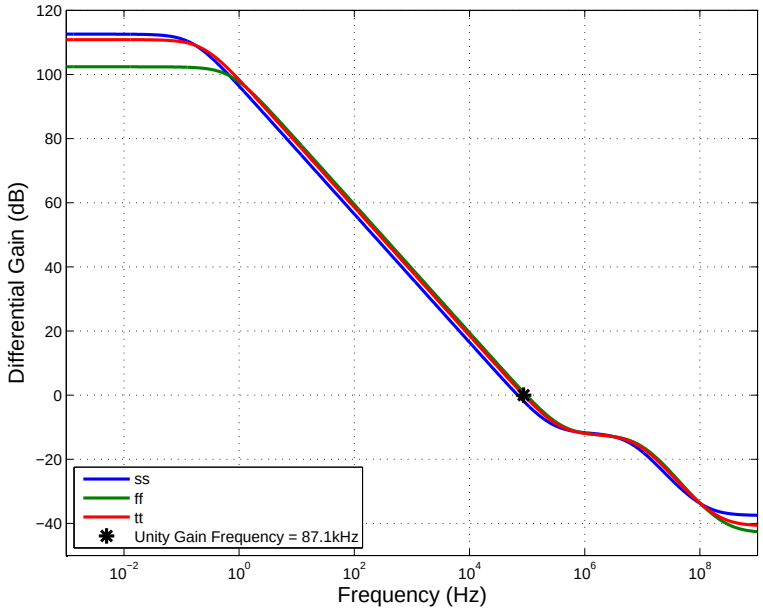

Fig. 1. The open loop differential gain magnitude response of the OTA.

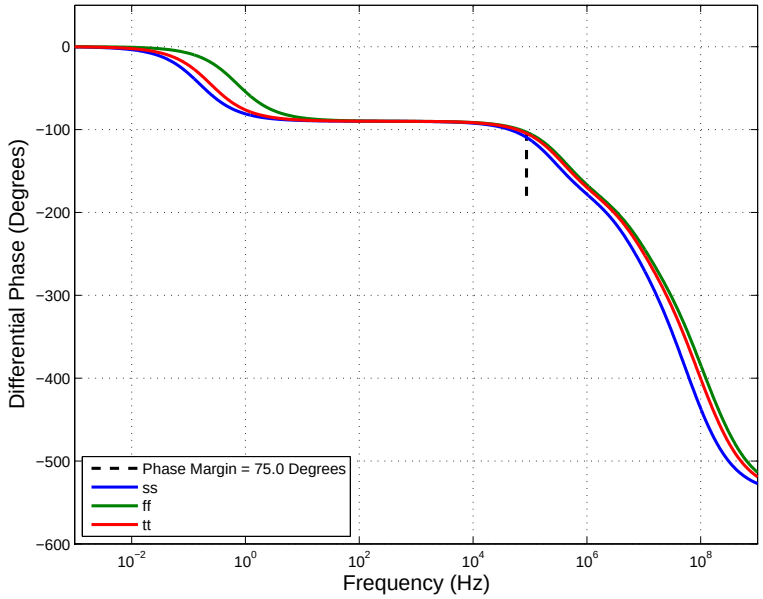

Fig. 2. The open loop differential gain phase response of the OTA.

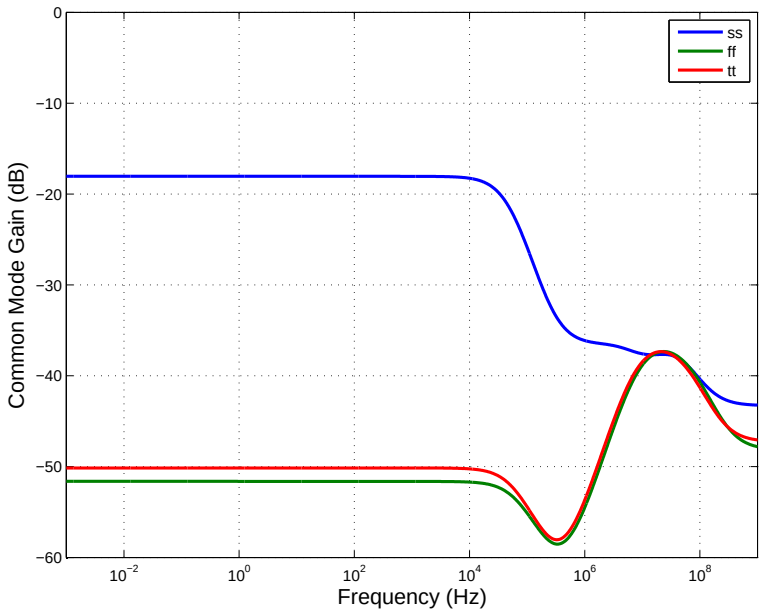

Fig. 3. The open loop common mode gain magnitude response of the OTA.

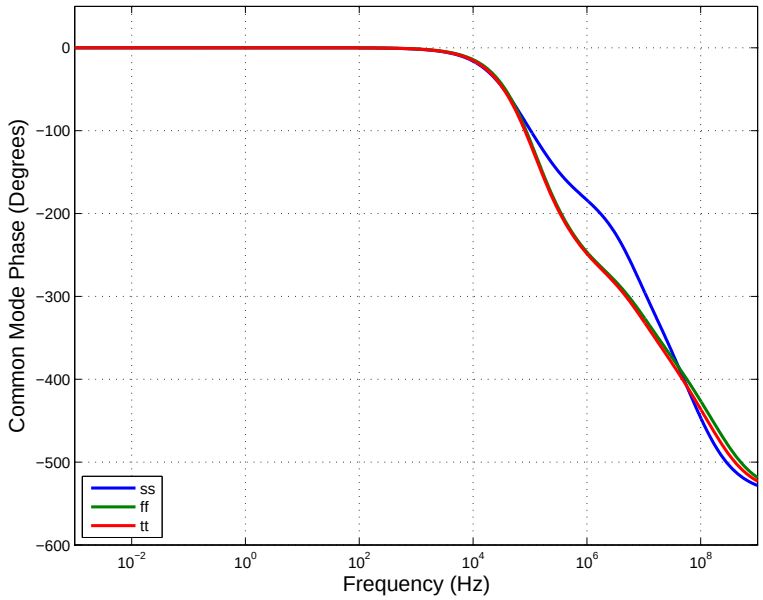

Fig. 4. The open loop common mode gain phase response of the OTA.

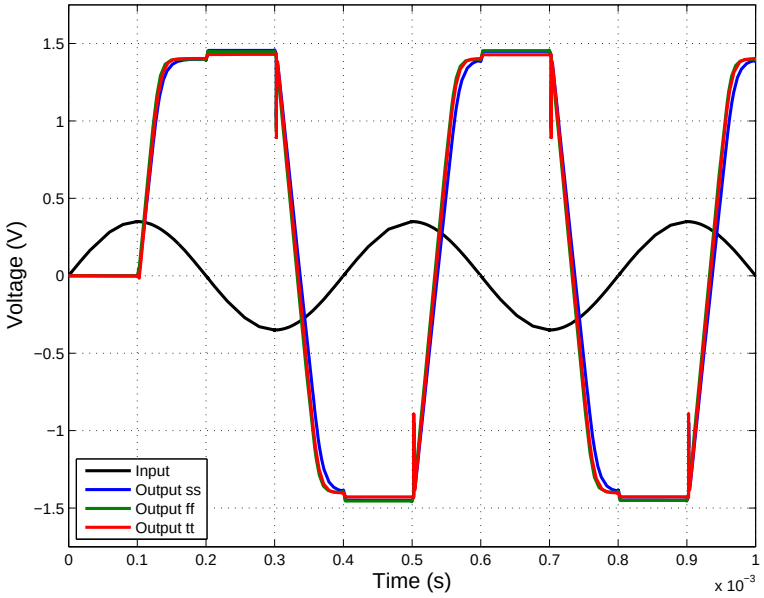

Fig. 5. The closed loop transient response to a full-scale amplitude sinusoid at the Nyquist frequency.

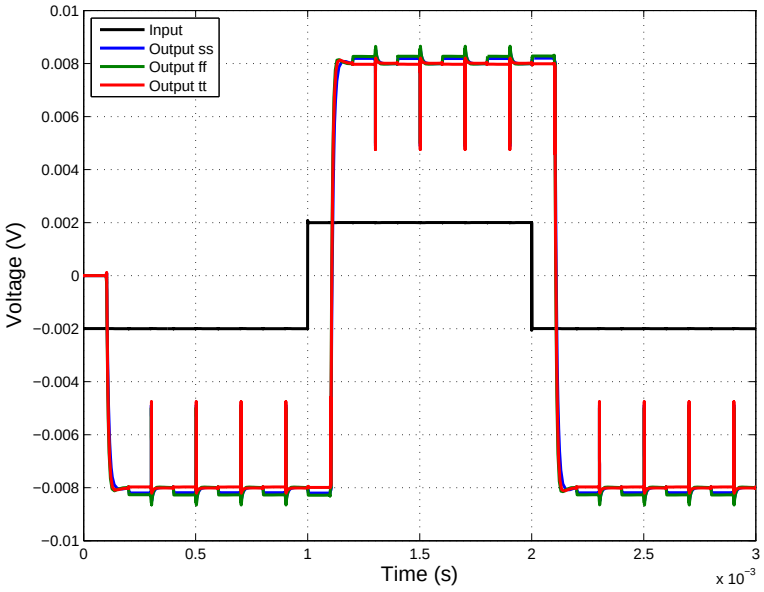

Fig. 6. The closed loop transient response to a small amplitude step input.

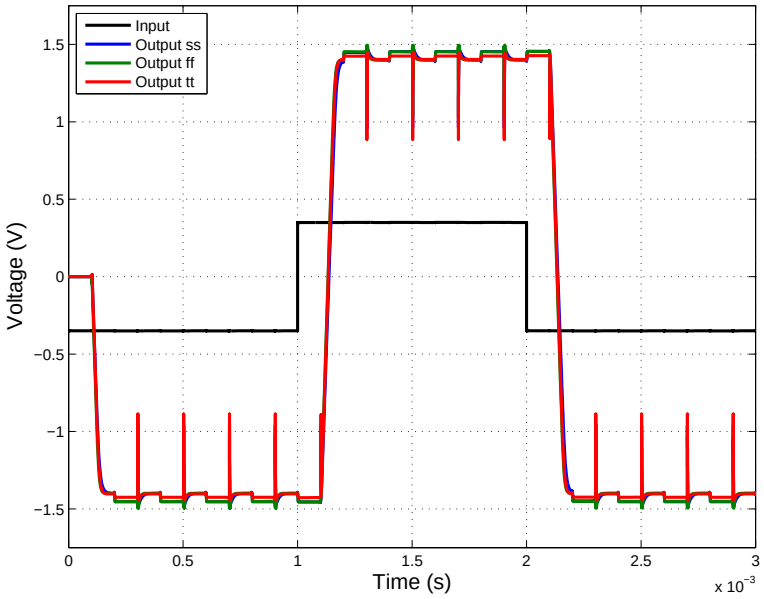

Fig. 7. The closed loop transient response to a full-scale amplitude step input.

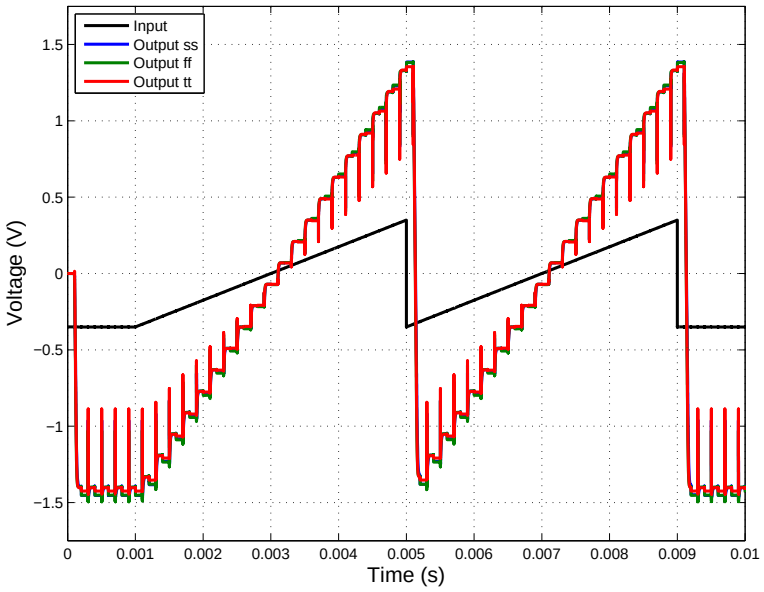

Fig. 8. The closed loop transient response to a full-scale amplitude sawtooth with a frequency of $\frac{f_s}{20}$.