Abstract - The conceptual design of a MGY tolerant configurable discrete time signal conditioning circuit in a 0.13 and 0.7µm CMOS technology is presented, for use with resistive sensors like strain gauge pressure sensors. The design features a differential preamplifier using a Correlated Double Sampling (CDS) architecture at a sample rate of 20kHz. Furthermore, a high voltage buffer and level shifter is presented in the 0.7µm design. The gain is digitally controllable between 27 and 400. The nominal input referred noise voltage is only 8.6µV at room temperature. The circuits have a simulated radiation tolerance of more than 1MGy. Simulations were based on results obtained from [1,2].

Design 0.7µm

Maximum Vth shifts [1]

<table>
<thead>
<tr>
<th>TID (MGy)</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>VthNMOS</td>
<td>-500mV</td>
</tr>
<tr>
<td>VthPMOS</td>
<td>+500mV</td>
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</tbody>
</table>

Voltage buffer and level shifter

• Integration of high voltage buffer
• High output swing
• Input noise = 8.5µV or 22nV/V/Hz
• P_PREAMP = 1mW

Output of complete amplifier for 500Hz and 1mV input.

Output of complete amplifier for a 500Hz and 300µV input.

Conclusion - The conceptual design of a instrumentation amplifier has been presented showing a 1MGy radiation tolerance within a temperature ranging from 0°C to 85°C. The CDS architecture offers the benefit of intrinsic rejection of both offset and 1/f noise. This is especially important in radiation environments as the 1/f noise, related to surface defects, tends to increase under radiation as defects are created at the gate oxide channel interface. Furthermore, both designs show that the voltage gain has a guaranteed accuracy of 1.5% over the whole gain range under extreme conditions. In addition, the 0.7 µm design presents a buffer which allows high voltage output levels.

References: