Abstract—This paper presents a design of an ultra low-power operational transconductance amplifier (OTA) intended for biomedical applications and realized in a 0.18 µm CMOS technology. The proposed OTA takes advantages of bulk-driven (OTA) scheme to reduce power consumption. The OTA uses a single 0.8 V supply and dissipates 5.5 pW of power and provides 70 dB gain which makes it suitable for use as a main block of many biomedical applications including implantable and wearable sensors. The simulation results are compared with conventional OTA structures and some recent works and indicate significant increase in gain while indicating a reduction in power consumption.

\[ I_D = I_0 \frac{W}{L} \left[ \exp \left( \frac{-|V_{GS} + (\eta - 1)W_{PS}|}{\eta V_t} \right) \right] \left[ 1 - \exp \left( \frac{V_{DS}}{V_t} \right) \right] \]

<table>
<thead>
<tr>
<th>MOSFET</th>
<th>W/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1A</td>
<td>3µm/0.18µm</td>
</tr>
<tr>
<td>M2A</td>
<td>3µm/0.18µm</td>
</tr>
<tr>
<td>M2B</td>
<td>3µm/0.18µm</td>
</tr>
<tr>
<td>M1B</td>
<td>3µm/0.18µm</td>
</tr>
<tr>
<td>M4A</td>
<td>3µm/0.18µm</td>
</tr>
<tr>
<td>M4B</td>
<td>3µm/0.18µm</td>
</tr>
<tr>
<td>M3A</td>
<td>3µm/0.18µm</td>
</tr>
<tr>
<td>M3B</td>
<td>3µm/0.18µm</td>
</tr>
<tr>
<td>M5A</td>
<td>3µm/0.18µm</td>
</tr>
<tr>
<td>M5B</td>
<td>3µm/0.18µm</td>
</tr>
</tbody>
</table>
A 60\textdegree{}83.2 dB gain OTA operating at 0.25\textdegree{}178 \textmu{}m process, an enhanced bulk CMOS OTA for biomedical applications was presented. This work was carried out using a 32nm±0.15 V Bulk process.

### Table II: OTA Performance Comparison

<table>
<thead>
<tr>
<th>This work</th>
<th>[2]</th>
<th>[3]</th>
<th>[4]</th>
<th>[5]</th>
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</thead>
<tbody>
<tr>
<td>Process (\mu{}m)</td>
<td>60</td>
<td>83.2</td>
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<td>83.2</td>
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<tr>
<td>Supply (V)</td>
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<td>Gain (dB)</td>
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<td>GBW (MHz)</td>
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<tr>
<td>PM (\textdegree{})</td>
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<td>60</td>
<td>60</td>
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<tr>
<td>SR (V/ms)</td>
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<td>200</td>
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<tr>
<td>CMRR (dB)</td>
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<td>82.3</td>
<td>82.3</td>
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<tr>
<td>Power (W)</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**References**