Statistical Simulations of Bandgap Circuits

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Introduction

- 1st statistical circuit simulation results have been published in [4] on transimpedance amplifiers
- Here: extension to bandgap designs
- PCM contains bandgap circuits as general purpose monitor
- 2 different sizings used
- Statistical models use data from 50 lots, Feb to May 05
- Bandgap measurements from 1th half of 2007
bandgap circuit
**Bandgap 1**

### 939 PCM Devices

- **LSL PCM**
- **USL PCM**

### 1000 MC Simulations

- **Min**
- **Max**

### QQ-plot distr= norm

- **VBG1**
- **BGR_1**

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**References**

WK Oct 19th, 2007 - 4 / 7
Comparison measurement vs simulation, $T = 25^\circ C$

<table>
<thead>
<tr>
<th></th>
<th>unit</th>
<th>BGR_1</th>
<th>BGR_2</th>
</tr>
</thead>
<tbody>
<tr>
<td>emitter size</td>
<td>$\mu m$</td>
<td>4.7/0.5</td>
<td>0.7/0.5</td>
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<tr>
<td>resistor width</td>
<td>$\mu m$</td>
<td>8.0</td>
<td>1.6</td>
</tr>
<tr>
<td>mean (measurements)</td>
<td>$V$</td>
<td>1.195</td>
<td>1.236</td>
</tr>
<tr>
<td>sdev (measurements)</td>
<td>mV</td>
<td>5.9</td>
<td>14.1</td>
</tr>
<tr>
<td>mean (simulation)</td>
<td>$V$</td>
<td>1.198</td>
<td>1.250</td>
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<tr>
<td>sdev (simulation)</td>
<td>mV</td>
<td>4.9</td>
<td>15.1</td>
</tr>
</tbody>
</table>

- under way: further mismatch modeling
- to do: extend statistics to s-parameters
- Acknowledgments to H. Dietrich for providing measurement data of the bandgap circuits and W. Schneider who did the simulations
References


