A Comparison between Common-source and Cascode Topologies for 60GHz Amplifier Design in 65nm CMOS

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Issues of mmW amplifiers design

• Issue
  – Gain
  – Power consumption
  – Impedance matching
  – Output power
  – Stability factor
  – Linearity
  – Noise figure
  – Hot-carrier injection

• Topology
  – Common source
  – Cascode
  – Gain-boost Cascode

\[ \text{Gain-boost Cas.} \]
Comparison of CS and Cas. topologies

<table>
<thead>
<tr>
<th>Issues</th>
<th>CS</th>
<th>Cas.</th>
<th>Gain-boost Cas.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum gain</td>
<td>△</td>
<td>△</td>
<td>O</td>
</tr>
<tr>
<td>Power consumption</td>
<td>△</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Isolation</td>
<td>×</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Stability factor</td>
<td>×</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Output power</td>
<td>O</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Linearity</td>
<td>O</td>
<td>△</td>
<td>×</td>
</tr>
<tr>
<td>Noise figure</td>
<td>O</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>Life time</td>
<td>×</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

Trade-offs of the topologies are considered for different mmW amplifiers design