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| --- | --- | --- | --- |
| Node | Time Constant | Assumptions/Simplifications | Simplified Time Constant |
| 1 - Input |  | * Cin >> Cgs2 |  |
| 2 - Vx |  | * R2/R1 < 4 |  |
| 3 - Vy |  | * R3/R4 < 4 |  |
| 4 - Vz |  |  |  |
| 5 - Vout |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Stage | Gain | R in terms of gain | Equals | Simplified Time Constant |
| 1 - CG |  | R2 = 4R1  = gain  => = = gain  => R1 = 5/4\* gain | 5000 |  |
| 2 – Cascode |  | R3 = 4R4  = 5  => = 5  => = 5  => R4 = | 5 |  |
| 3 – CS |  |  | 1.2 |  |
| 4 – CD |  |  | 1 |  |
|  |  |  |  |  |

Script overview

1. Find gain equation at each of the 4 stages
   1. Ignore ro, assume ro >> R1-4
2. Find RC time constaint at each node
   1. Ignore Cgd b/c Cgd = Cov << Cgs = 2/3WLCox + Cov
   2. Ignore bulk terminal caps b/c hard to estimate
3. Power ≤ 2mW, Vdd - Vss = 5V→ Ids\_tot ≤ = 400A
4. Pick Vov = typical 0.3; L = 0.2um
5. Sweep over Ids distribution over 4 branches and 4 stage gains allocation
   1. 4 branches of Ids sum up to Ids\_tot
   2. Product of 4 stages’ gain equal to our target gain of 30k
6. During each iteration, calculate:
   1. gm and W for each xtor
   2. R1-R4
   3. tau for the 5 major nodes (in, x, y, z, out)
   4. from tau calculate f-3db see if it meets our spec of 90MHz

First pass design strategy

1. Find gain equation at each of the 4 stages
   1. Ignore ro, assume ro >> R1-4
2. Find RC time constaint at each node
   1. Ignore Cgd b/c Cgd = Cov << Cgs = 2/3WLCox + Cov
   2. Ignore bulk terminal caps b/c hard to estimate
3. Product of the 4 gains >= 30k. Allocate a percentage of 30k for each stage
4. 1/(sum of all nodes’ time constants) >= 90MHz. Allocate a percentage of 1/90Mhz for each node.
5. At this point, we have each stage’s gain in function of gm, R; each node’s time constant as a function of gm, R, C. We can correlate the 2 equations to assign values to gm, C, R variables.
6. From gm, we can find W.
7. After all xtors are sized, we will calculate Ids of the xtors connected to Vbias-Gen to determine the biasing voltage.