Part1

Question 1:

NMOS Charts

Graphical user interface, chart

Description automatically generated

PMOS Charts

Graphical user interface, chart

Description automatically generated

Question 2:

ID vs VGS Plots for NMOS that has gm/ID = 10, gm/gds = 50, VDS = VDD/3, VSB = 0, and W = 5u.

Graphical user interface, chart

Description automatically generated

Question 3:

Matlab Results

Graphical user interface, text, application

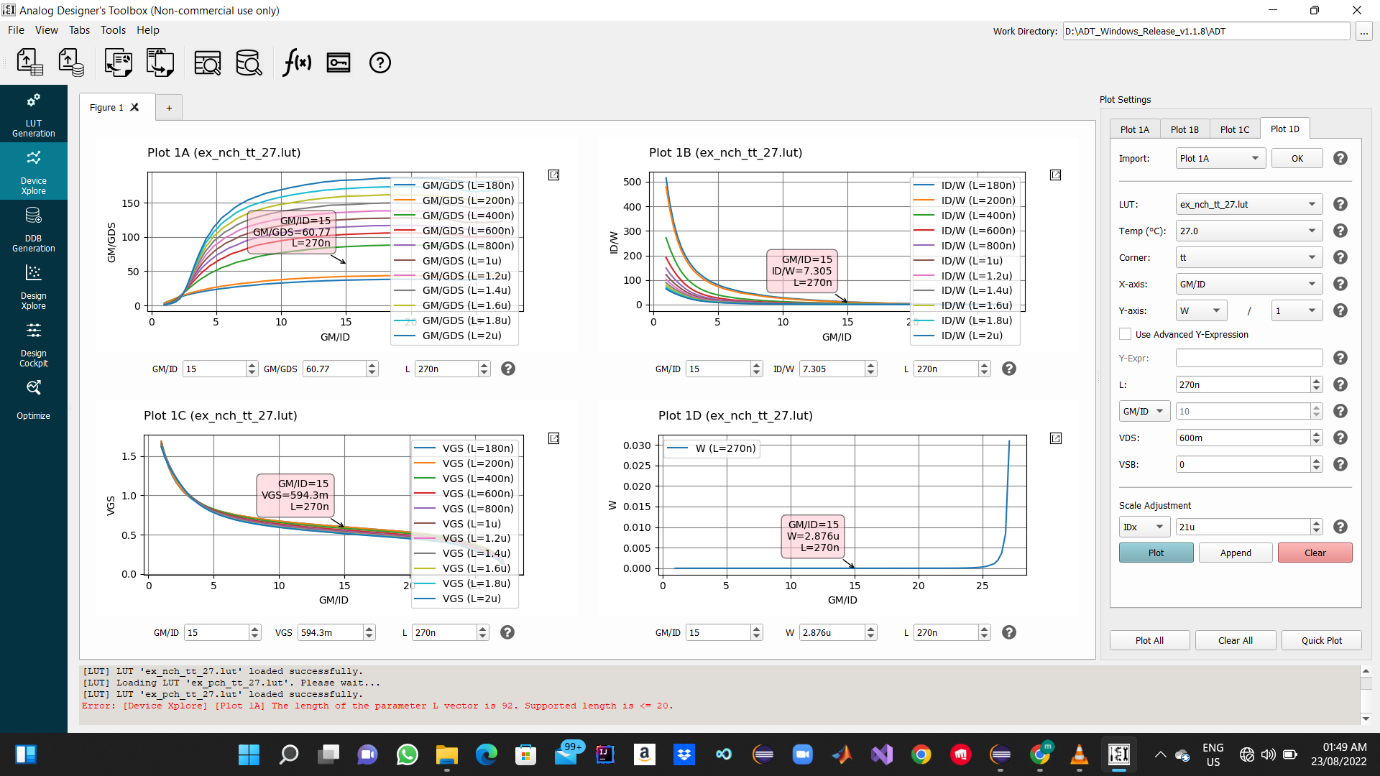
Description automatically generated

|  |  |  |
| --- | --- | --- |
| MATLAB | VGS=0.67v | ID=95.2u |
| ADT | VGS=0.67v | ID=99u |

This slight difference in Id Because of using Different LUT in Each Program as ADT Uses LTSpice Generated LUT While Matlab Uses Hspice Generated LUT.

Question 4:

Input Pair Sizing



Used Some Hand analysis to get Gm and with the Assumptions got the above points , Vgs Determined to Add CM to bias The devices.

Pmos Current Mirror Load Sizing Graphical user interface, chart

Description automatically generated

Tail Current Source Sizing

Graphical user interface, chart, application

Description automatically generated

|  |  |
| --- | --- |
| Gm/id assumptions | For the input stage we used large gm/id as its gm Contributes at The gain and less random mismatch , while for the load and tail cs we used small gm/id as there gm doesn’t Contribute at Gain and to have smaller area to get small capacitances from them and to have a less effect of VDS on Current As Va increase. |
| Ro assumptions | We used 5ro for The load To have A Less VDS Effect at the current from The load |
| Tail Current Source L assumptions | As L increase Ro tail cs increase so Cm gain decrease and cm rejection ratio increase , and have an accurate current Value as VDS Effect Decrease as Ro increase . |

Question 5: A screenshot of a computer

Description automatically generatedText

Description automatically generated

Question 6: Test Script

Graphical user interface, text, application

Description automatically generated

Matlab Results (No Parasitic Caps)

Graphical user interface, text, application

Description automatically generated

Question 7:

Netlist & Simulation Results (No Parasitic Caps)

A screenshot of a computer

Description automatically generated with medium confidence

|  |  |  |
| --- | --- | --- |
|  | Specs | Spice Results |
| GBW | 100 Mega hz | 1.77\*Mega\*51.2 = 92 Mega hz |
| DC Gain | 34 db | 34.3db |

The Dc Gain Is Achieved but there is an error at the GBW this is due neglecting the parasitic caps , but it will effect the GBW as there order of magnitude is the same as Cl (Femto).

PART 2 :

Question 1

Input Pair Sizing While Taking Parasitic Caps in calculations

Graphical user interface, diagram

Description automatically generated

Current load Sizing While Taking Parasitic Caps in calculations

Graphical user interface, diagram, application

Description automatically generated

Tail Current Source Sizing While Taking Parasitic Caps in calculations

Graphical user interface

Description automatically generated

The Methodology I Used Was Calculating Both CDD for Input and Current Mirror Load Then Calculating Gm From GBW Equation And Continue Design As usual .

Question 2:

Matlab Function

Graphical user interface, text

Description automatically generated

Graphical user interface, text, application

Description automatically generatedGraphical user interface, text, application

Description automatically generatedGraphical user interface, text

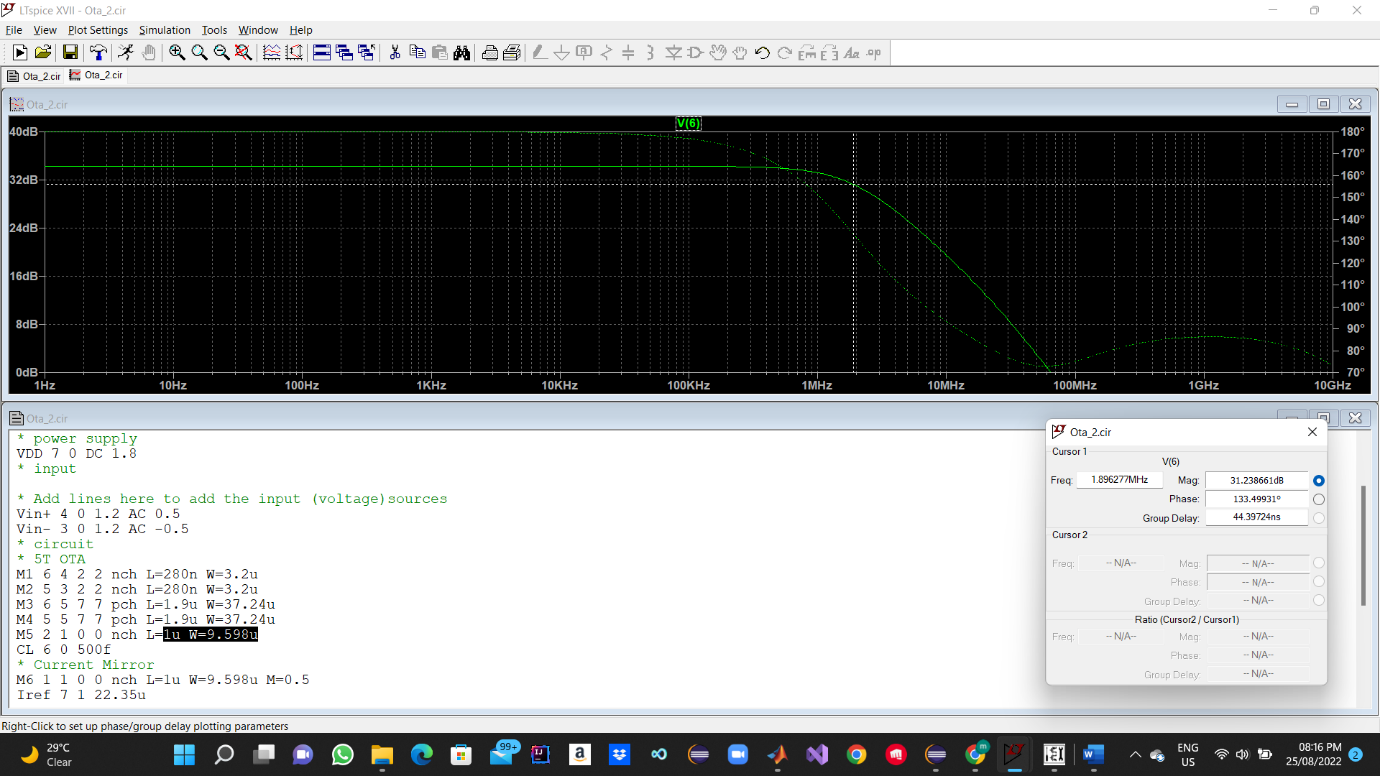
Description automatically generated

The Function Takes The Effect of Parasitic Caps in Consideration it Iterates Until it Founds The best Sizing values With 8% Percent tolerance to stop at the gm Value.

|  |  |  |
| --- | --- | --- |
| ADT  With Parasitic Caps | MATLAB Part1  No Parasitic Caps | MATLAB Part2  With Parasitic Caps |
| Input Pair:  W= 3.2u  L=280n  Current Mirror Load :  W= 37.24u  L=1.9u  Tail Current Source :  W=9.598u  L=1u | Graphical user interface, text, application, Word  Description automatically generated | Graphical user interface, text, application  Description automatically generated |

There Are Difference Between ADT And Matlab Results As Matlatb LUTs Are made on Hspice While ADT LUTs are made on LTspice , MATLAB Function 2 Has Tolerance 8% Stoping Iterations Condition , When The gm is changed while Calculating it from The GBW as Adding caps in calculations .

Question 3:



|  |  |  |
| --- | --- | --- |
|  | Specs | Spice Results |
| GBW | 100 Mega hz | 1.89\*Mega\*51.286 = 97 Mega hz |
| DC Gain | 34 db | 34.2db |

As we took the Parasitic Caps Into Consideration We Have A better Accuracy for the specs as the error become 3% only .