

# Title: Class F Power oscillator

Name: Belal Ali Ramadan

Date: 5/12/2021

## Objective:

Our target is to build a differential cascode class F PO at a frequency 915MHz and minimize dissipation in the MOSFET transistor by the concept of reducing overlapping between drain voltage and drain current.

MOSFET Used: N\_HGLV\_33\_130LE.

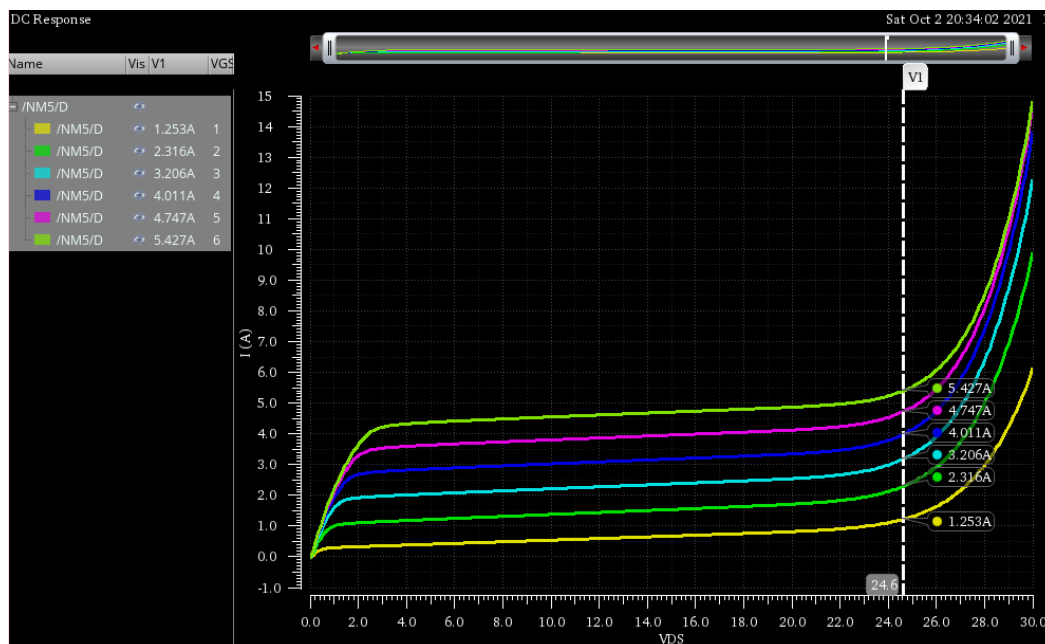


Figure 1:  $I_D$ - $V_{DS}$  Saturation region.

## ID-VGS Chs:

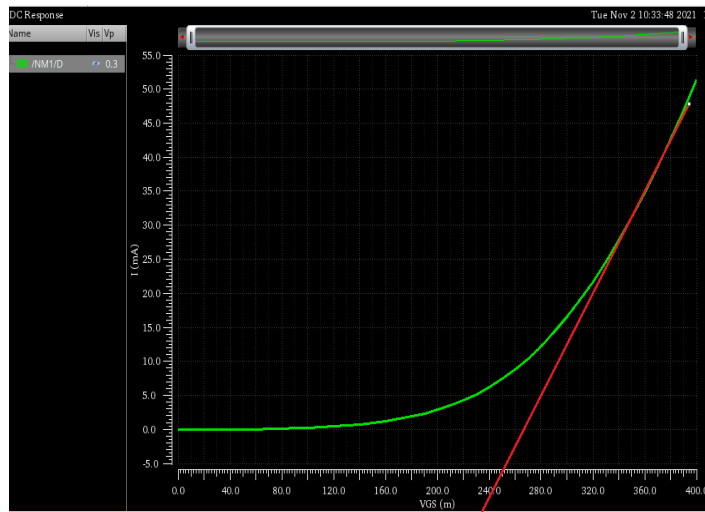


Figure 2: ID\_VGS Chs.

## Schematic:

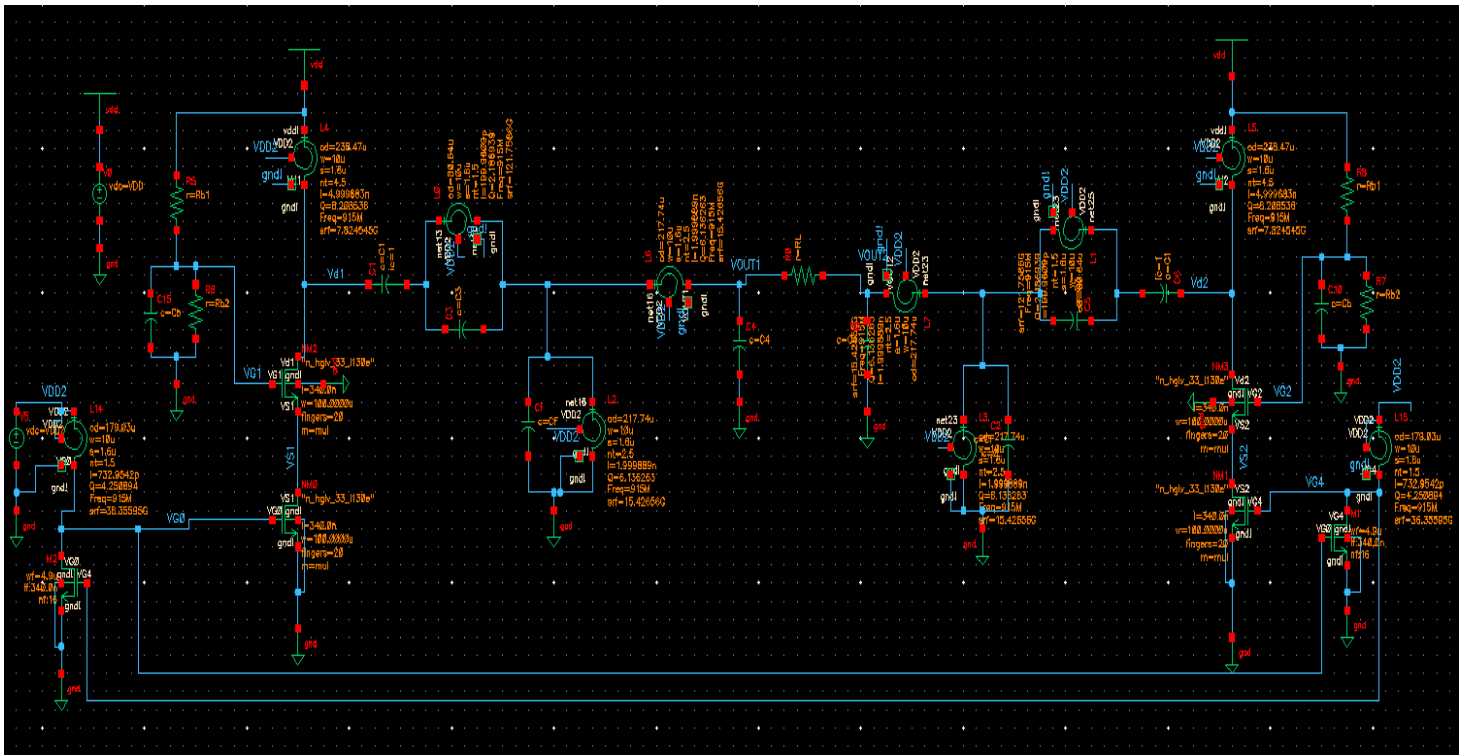
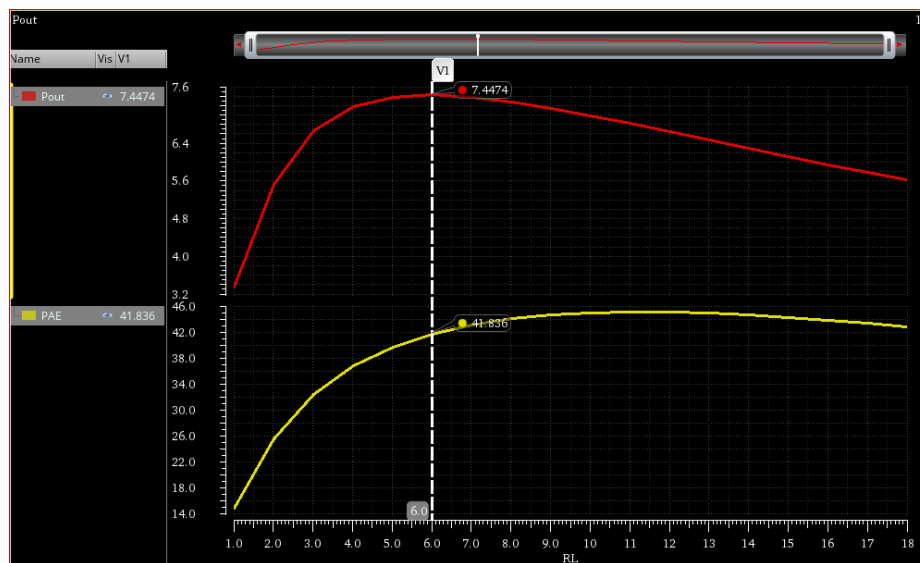


Figure 3: Schematic

## Parameters:

	(W/L)1,2,3,4	WG	nf	mul	C1	RFC1,RFC2
Value	$\frac{9000u}{0.34u}$	5u	20	90	50pF	5nH,2nH
	CF	LF	C3	L3	VDD2	(W/L)5,6
Value	15.1pF	2nH	16.6pF	200pH	1.3V	$\frac{3000u}{0.34u}$
	RL	C4	L4	VDD1	Rb1,Rb2	Cb
Value	50Ω	10.1pF	2nH	16V	1k,600 Ω	30p

## Sweeping RL:



**Figure 4: Pout and PAE vs RL.**

-Point of maximum power is almost at  $RL = 6 \Omega$ .

## Waveforms:

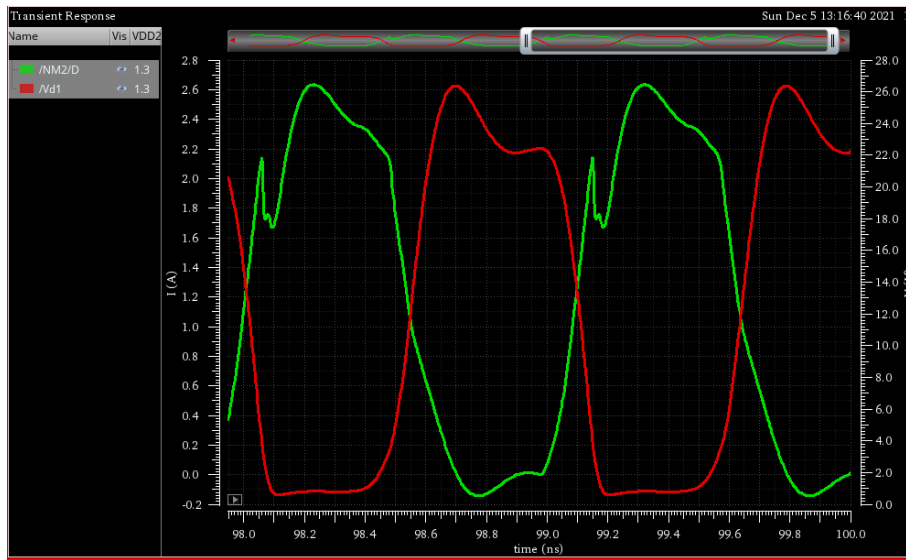


Figure 5: Drain voltage and current

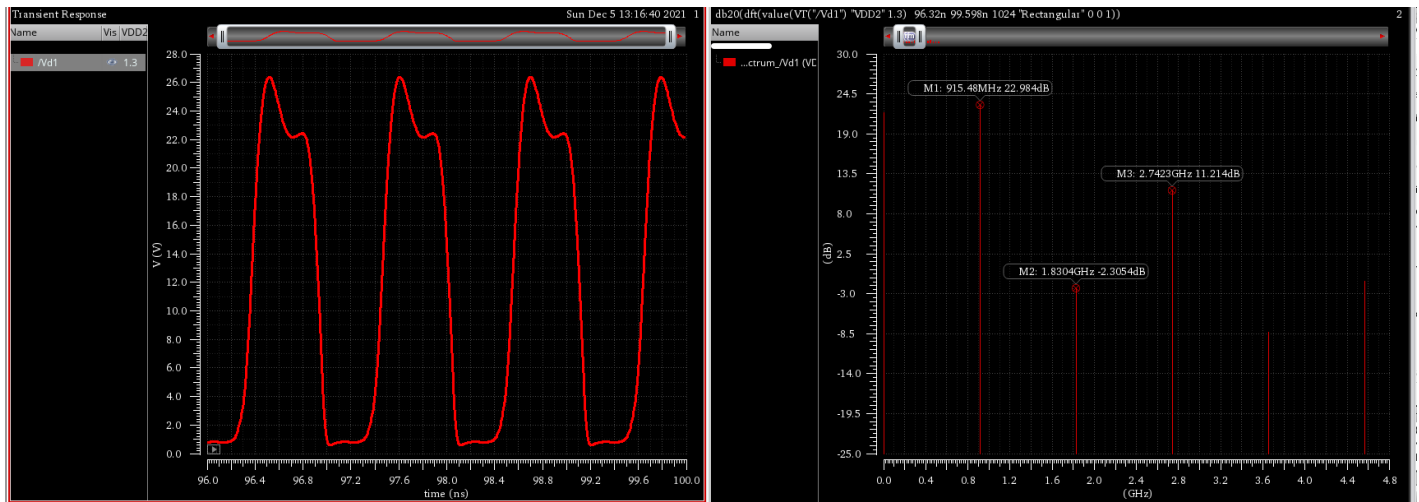


Figure 6 : Vd spectrum.

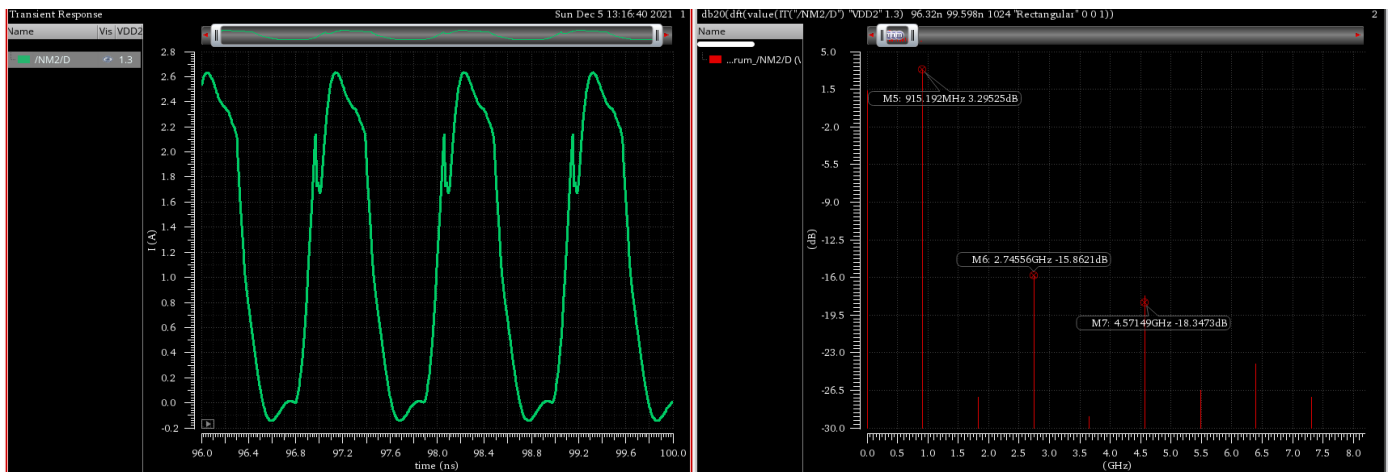


Figure 7: ID spectrum

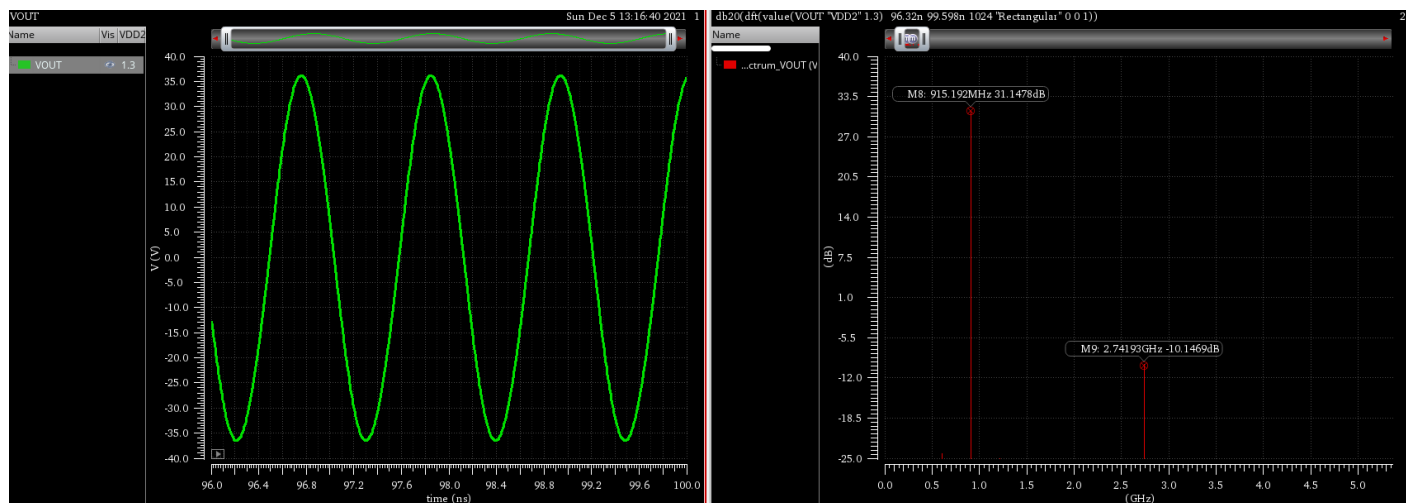


Figure 8: VOUT

Outputs:

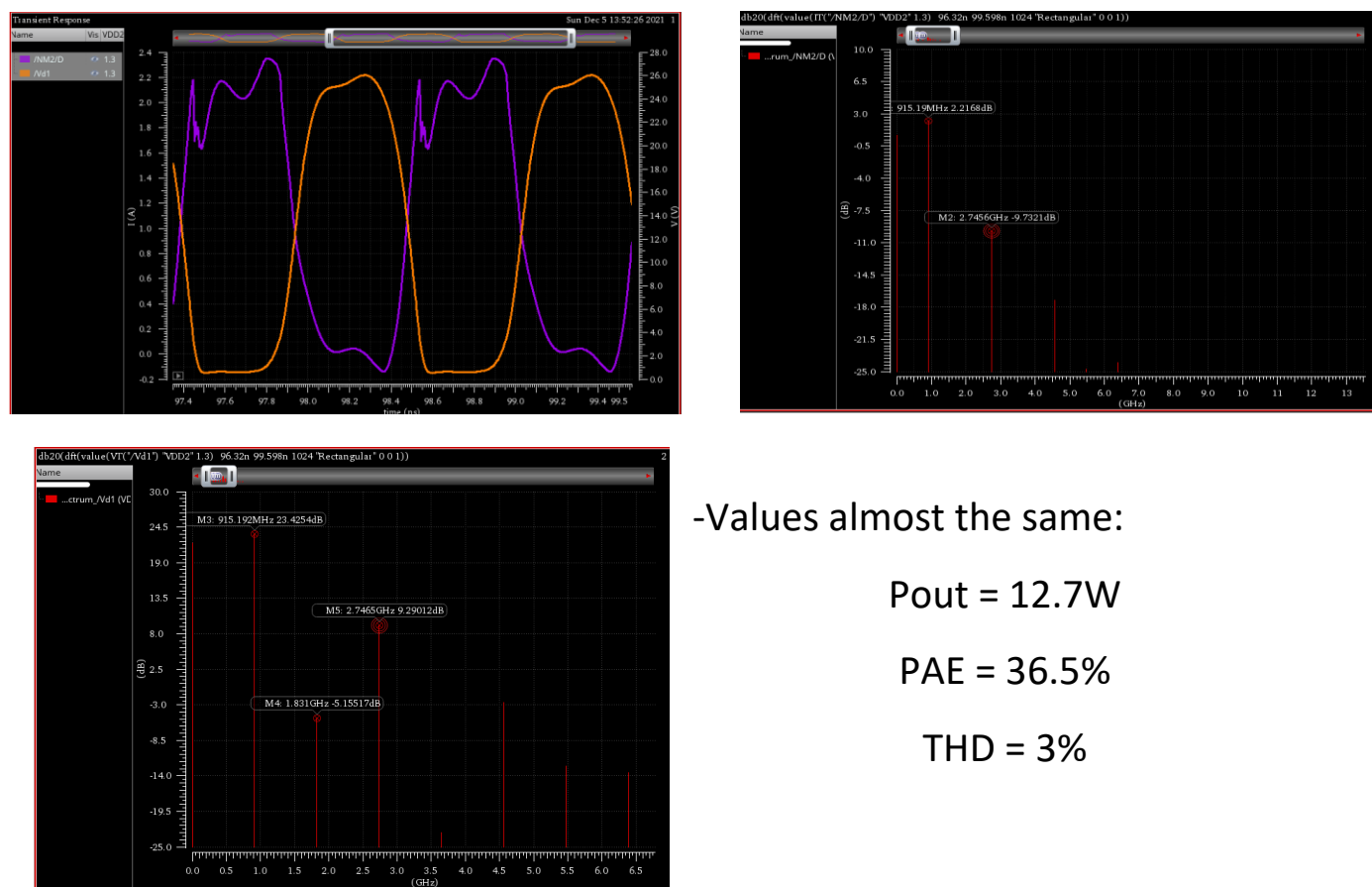
Pdc	38.22
Pout	13.12
PAE	34.33
THD	906.4m

**Pout = 13.1W**

**PAE = 34.3%**

**THD = 0.9%**

-I don't know why but after putting the MOM caps, waveforms turn to this:



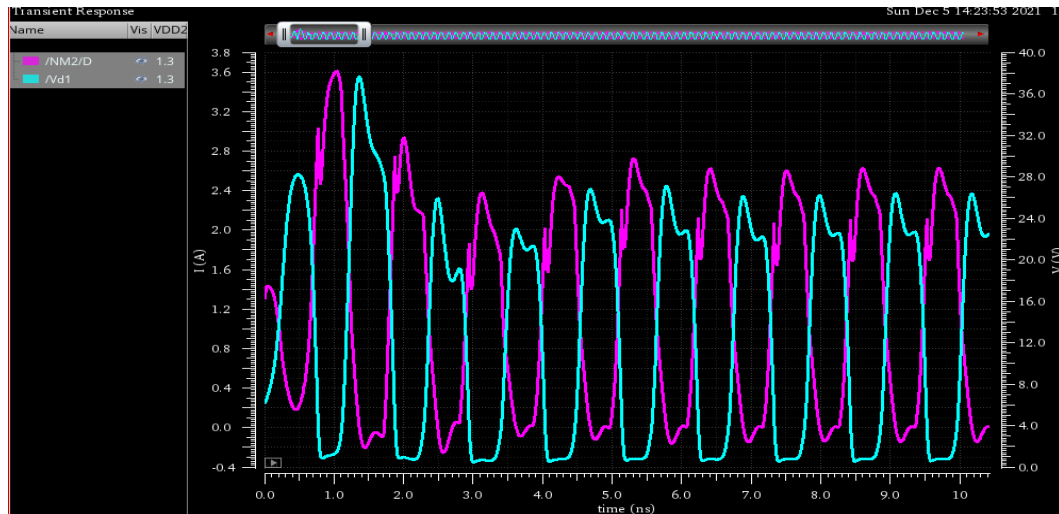
-Values almost the same:

**Pout = 12.7W**

**PAE = 36.5%**

**THD = 3%**

-There is a large pulse when the circuit starting to operate causes break down on the cascode transistor, I don't know that's important or not, I can't get rid of it.



**Figure 9**

#### Discussion:

-Degraded values at 434MHz,  $P_{out} = 7W$  and  $PAE = 20\%$ .

-Large losses in the circuit due to smaller Q of the inductors, May with some techniques in layout, we could reach a higher Q and better PAE.