DESIGN AND DEVELOPMENT OF LOW POWER WIDE FREQUENCY BAND RKTG PAIR PUSH PULL AMPLIFIER

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Abstract: In this research paper we have investigated push-pull amplifier circuit using RKTG pair amplifier to optimized the performance of the amplifier. The proposed circuit works for low input power with high voltage gain and very wide band frequency (ZHz). The proposed circuit shows good temperature stability and sufficient voltage gain at low value of inductance having value of pico-Henry.

Keywords: Distortion, Frequency Response, Push Pull Amplifier, RKTG pair and Temperature stability.

INTRODUCTION

The large signal amplifier as power amplifier is a building block for all radio frequency communication. It provides sufficient power to an output load to drive output power device also the push-pull amplifier is most popular versatile power amplifier. The push-pull amplifier is frequently preferred over the other power amplifier to extend high efficiency and make distortion less using CMOS technology. But now the present days, electronic market is required amplification of very low input voltage signal at very high frequency band without any distortion. This is a major problem for the researchers and designers of electronics fields. They have studied and designed properly by many investigator with the help of cascading of transistors, Darlington pair, RC coupled transistor, Transformer coupled transistors etc. [1]-[5].

This paper presents the push pull amplifier with complementary compound pair (RKTG pair) using CMOS technology. This technology has two major useful characteristics like very low static power consumption and high noise immunity [6],[7]. In this research paper, we used additional elements like – Complementary compound pair, Very low value of inductor at output port, high value of register (in Mega ohm) as output load of push pull amplifier which provide increased band width and gain.

A distortion identified by nonlinearity of the dynamic characteristics may be eliminated by using push pull class B power amplifier [8], [9]. When two CMOS inverters are connected is series having an ac input signal, voltage divided biasing with load at 100 KΩ shown as a reference circuit in fig (1). Then the simulated result show frequency band in KHz [10]-[15]. It can be improved by replacing the CMOS inverter with complementary compound pair and very low value of inductor (pH) and R_L (M ohm) as a output load of power amplifier.

EXPLORATORY CIRCUIT

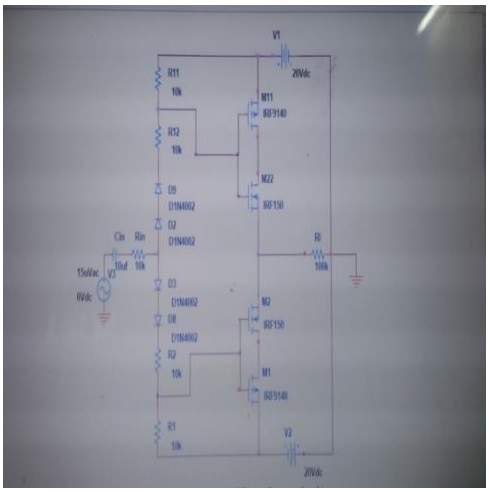

Fig-1 CMOS Push Pull amplifier (reference circuit)

Bandwidth in KHz. It is very low as compare to proposed circuit.

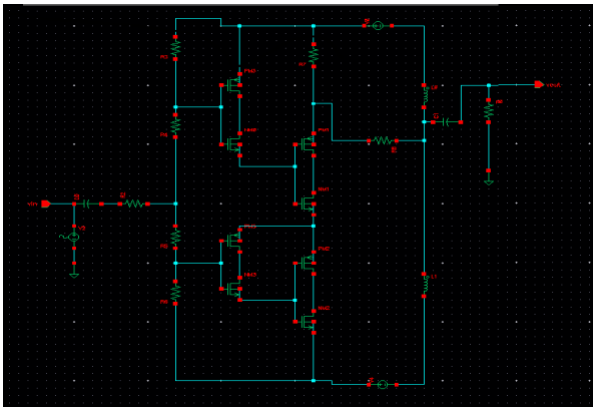

Fig-2 Exploratory circuit of RKTG Pair amplifier Hence, this proposed circuit is very usefulfor ultra wide band large signal amplification. Other advantages are like high temperature stability (no temperature effect at high frequency), low output noise at higher frequency. We found 69mW low power consumption and ultra wide frequency band at L_1=L_2=1pH and R_L= 1MΩ shown in following simulation results.

SIMULATION RESULTS

Proposed circuit shown in the fig (2). When the value of inductor is varies between the 0.5 pH to 10 pH with high output load (1MΩ) then the maximum low cut off frequency is 18.21KHz and high cut off frequency is 574.9ZHz shown in fig-4, while the reference circuit have

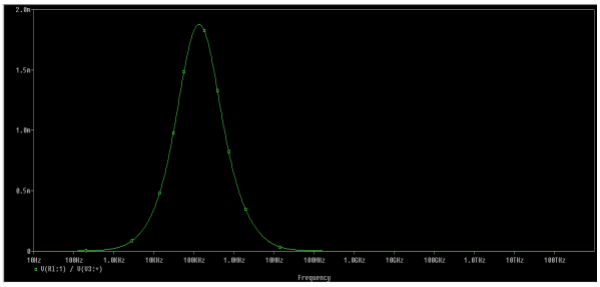

Fig.3 Frequency Response of Reference Circuit

The frequency response of reference circuit fig(3) shows the minimum frequency band in KHz to MHz. That can be used for tuned frequency. While, proposed circuit for the push pull power amplifier can be specialized for ultra high frequency band KHz to ZHz shown in fig (4).

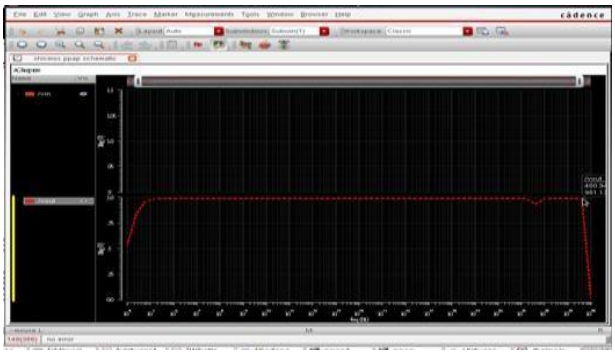

Fig.4 Frequency Response of Exclamatory Circuit

The transient analysis of exploratory circuit (fig.5) with respect to input and output shows that the amplifier has little distortion at output port. The complementary compound push pull amplifier has very low power consumption (69mW) at input supply 1V shown in fig.6.

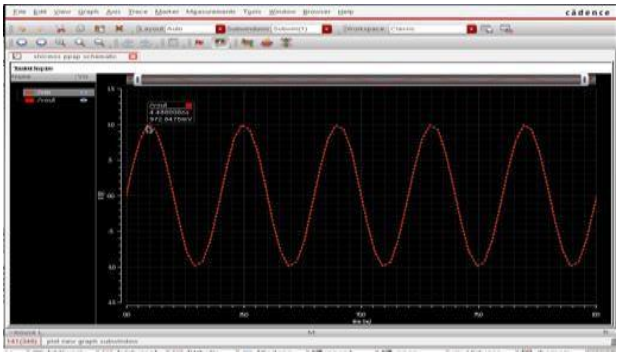

Fig-5 Transients analysis of proposed complementary compound push pull amplifier (no distortion)

This power can be more save up to uW by using less than 1V supply. But it affect on the gain and frequency band both. The simulated noise analysis is consists of output noise (fig.6), input noise (fig.7) and transfer function noise (fig.8).

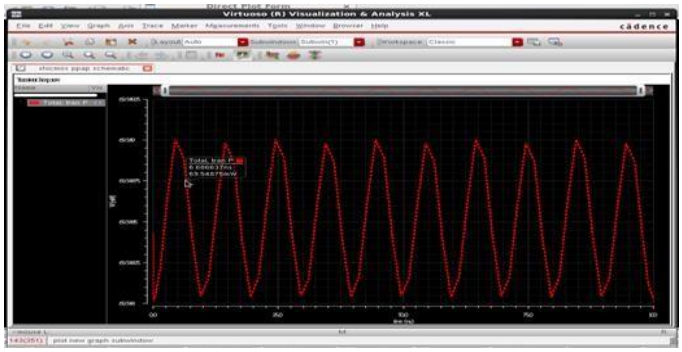

Fig-6 Power consumption in proposed amplifier (69mW)

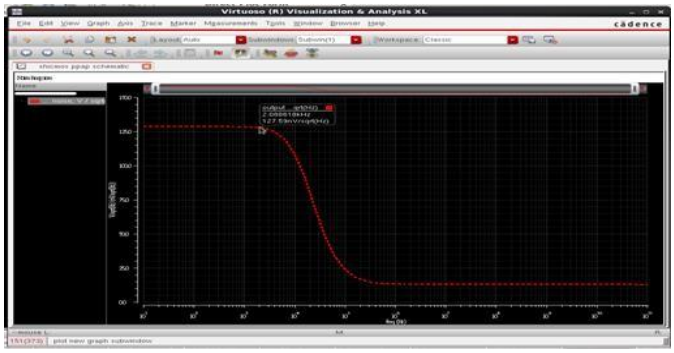

Fig-7 Output noise analysis of proposed amplifier

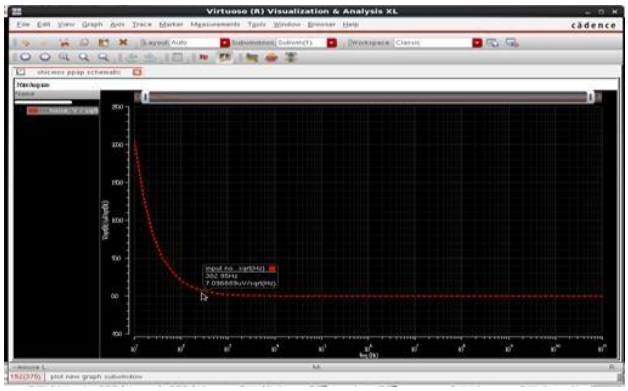

Fig-8 Input noise analysis of proposed amplifier

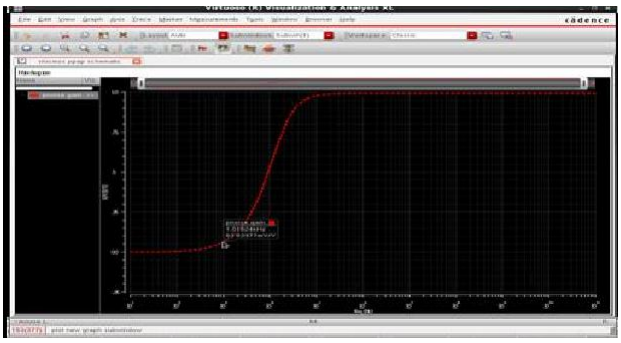

Fig- 9 Transfer function noise analysis of proposed amplifier

EXPERIMENTAL TABLE

Tools	Technique	Sup ply volt age	Frequen cy band	Power consum ption	Volt age Gain
180NM TECHNO LOGY	ADDING PASSIVE ELEMENT S REF[11]	1V	30KHZ – 614GHZ	-	20.9 DB
CADENC E 65NM	THREE STAGE COMMON SOURCE MOSFET REF.[12]	1V	60GHZ	-	8DB
CADENC E 180nm	COMPLE MENTRY COMPOU ND CMOS PAIR	1V	18.2KHZ – 574.9ZH Z	69MW	14.8 DB

CONCLUSION

Above simulation results lead to conclusion that this investigated RKTG pair push pull amplifier is very useful for ultra wide band ZHz at low input voltage 1V with low value of inductor 1pH and high output load 1MΩ. Our further investigation is to study and high Q CMOS inductor instead of inductor of this proposed complementary compound push pull amplifier to achieve very high voltage gain with zero power consumption.

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