DESIGN OF CMOS POWER AMPLIFIER CLASS 1 FOR BLUETOOTH APPLICATIONS

Diseño de un Amplificador de Potencia CMOS de Clase 1 para Aplicaciones Bluetooth

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PRESENTACIÓN: MAYO 2016 ACEPTACIÓN: JULIO 2016

ABSTRACT

A two stage cascade class AB power amplifier operating in 2.4Ghz was designed in a 130nm CMOS process for Class-1 Bluetooth applications. The power amplifier was polarized in class AB for a best midpoint between linearity and efficiency. The proposed power amplifier has an overall efficiency of the 39.6%, a power gain of 25dB and an output power of 20dBm.

Keywords: Power amplifier, Class-1 Bluetooth applications

RESUMEN

Un amplificador de potencia de dos etapas de clase AB en cascada operando a 2.4Ghz fue diseñado para un proceso de CMOS de 130nm para aplicaciones Bluetooth de Clase-1. El amplificador de poder fue polarizado en una clase AB para un mejor punto medio entre linealidad y eficiencia. El amplificador de potencia propuesto tiene una eficiencia total de 39.6%, una ganancia de potencia de 25dB y una salida de poder de 20dBm.

Palabras clave: Amplificador de potencia de clase AB, Aplicaciones Bluetooth de Clase-1

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INTRODUCTION

Bluetooth applications are becoming popular at the unlicensed 2.4 Ghz ISM Band, this technology provides a short range radio links between electronic devices, the best choice for low cost, low power comsumption and high integration is the use of CMOS technology.

The proposed power amplifier was designed in 130nm CMOS technology with 3.3V transistors with gate length equal to 340 µm to ensure high breakdown voltage and to minimize RF stress on the silicon oxide due HCS (Hot Carrier Stress) [1]. This process has 8 metal layers with a 2 µm thick top metal.

TABLE I. PERFORMANCE SUMMARY

Parameters	Results
Technology	130 nm CMOS
Operating voltage	3.3 V
Frequency	2.4 Ghz
Max. Output Power	22.5 dBm
PAE	36.9 %
Die Area	1244 µm x 516 µm

DESIGN METHODOLOGY

The PA was designed with two stages to increase the power gain. In the driver stage, the main transistor and the cascode transistor is 700 µm and 200 µm wide respectively, the power stage has 550 µm and 1.3 mm respectively. The class of amplification is AB for a good compromise between linearity and efficiency [2].

SIMULATION RESULTS

The Fig.1 shows the relationship between overall gain, output power and power added efficiency, for an input power about -4.3 dBm we can obtain a good performance between efficiency and ouput power.

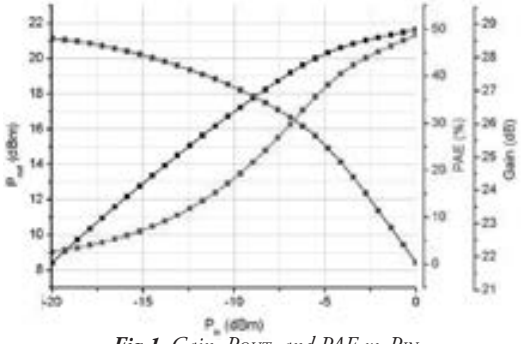

Fig.1. *Gain, Pout and PAE vs. Pin*

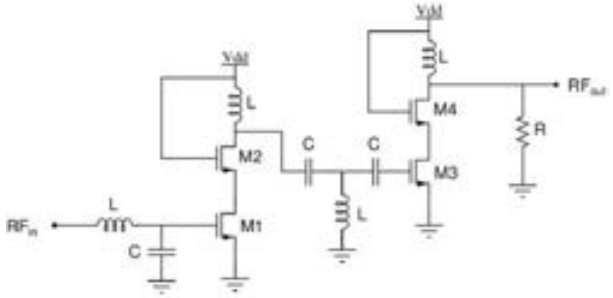

Fig.2. *Schematic of power amplifier.*

The final circuit schematic in Fig.2.

5. CONCLUSION

We have presented a CMOS 130 nm power amplifier using a thick oxide transistors and 3.3 V power supply, two stages with cascode topology. The proposed circuit is able to reach a Class-1 Bluetooth standard output power of 20 dBm and 39.6 % efficiency.

ACKNOWLEDGMENTS

The authors would like to thank "CTI Renato Archer" and CNPQ for their support.

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