

**PERFORMANCE ANALYSIS OF A WIDEBAND LNA UTILIZING
0.18 μ M TECHNOLOGY WITH HBM ESD PROTECTION**

**This thesis is presented in partial fulfillment for the award of the
Bachelor of Electrical Engineering (Hons)
UNIVERSITI TEKNOLOGI MARA
MALAYSIA**



NOR AIDA BINTI NORDIN

2007270672

Faculty of Electrical Engineering

UNIVERSITI TEKNOLOGI MARA

40450 SHAH ALAM, SELANGOR

ACKNOWLEDGEMENTS

All praise is to Allah S.W.T, The Most Gracious and Most Merciful who has given me the strength, ability and patience to complete this project. I would like to thank many people who made my life at Universiti Teknologi MARA so memorable and continuously encouraged me to complete my study toward my Bachelor's Degree.

First and foremost, I would like to express my sincere gratitude and appreciation to my project supervisor, Puan Maizan binti Mohamad for her invaluable guidance, patience and encouragement throughout the development of this project. Her advice and assistance in the preparation of this thesis is highly appreciated. I would also like to express my utmost gratitude to CEDEC staff for all the helped and guide during this project. Also, thanks to all my fellow colleagues for their invaluable support and motivation given either directly or indirectly towards the completion of this project. Special thanks to the staff of Faculty of Electrical Engineering for their assistance for the use of the facilities at the laboratory.

Last but not least, my deepest appreciation goes to my beloved family, especially my father and mother who are my greatest source of inspiration, for their moral support, motivation and understanding towards the accomplishment of this project.

ABSTRACT

The following report presents the performance analysis of wideband low noise amplifier (LNA) design circuits utilizing 0.18 μ m CMOS technology. The objective of this performed analysis of a LNA design that need achieve sufficiently large gain and low noise figure, compare the design with other design, and to verify the effect of parameter R_f and L_s to S-parameter. This LNA design was expected to achieve a peak power gain of 13.8 dB. Within the 3 dB bandwidth from 2.6 GHz to 6.6 GHz, the noise figure (NF) is in a range of 4.0 dB to 6.5 dB and the input reflection coefficient, S_{11} is below -13.0dB. The standard specification for LNA with bandwidth from 2.6GHz is ISDB. This usually used for digital audio and video broadcasting application. By using Cadence Virtuoso as an EDA tool as a simulation tool, the result are obtained. The simulation result had almost achieved the target and this analysis had performed successfully simulation.

TABLE OF CONTENTS

CHAPTER	LIST OF TITLE	PAGE
	DECLARATION	I
	DEDICATION	II
	ACKNOWLEDGEMENT	III
	ABSTRACT	IV
	TABLE OF CONTENTS	V
	LIST OF FIGURES	VIII
	LIST OF TABLES	X
	ABBREVIATIONS	XI
1.0	INTRODUCTION	
	1.1 INTRODUCTION	1
	1.2 PROBLEM STATEMENT	3
	1.3 PROJECT OBJECTIVE	4
	1.4 SCOPE OF WORK	5
	1.5 THESIS ORGANIZATION	5
2.0	LITERATURE REVIEW	
	2.1 INTRODUCTION	6
	2.2 LOW NOISE AMPLIFIER CONFIGURATION	6
	2.3 LOW NOISE AMPLIFIER PARAMETER	8
	2.3.1 S-Parameter	9
	2.3.2 Noise Figure	11
	2.4 CIRCUIT DESCRIPTION	12
	2.4.1 LNA Circuit	12
	2.4.2 ESD Protection Structure	13

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

CMOS technology is the most attractive choices for RF system-on chip (SOC) applications due to the rapid scaling of the feature size. The impressive frequency response of the transistors eases the requirement of achieving high speed circuit operation, while the reduced gate oxide thickness and lowered breakdown voltage pose a tremendous challenge for the on-chip electrostatic discharge (ESD) protection design since the sensitive gate oxide of the MOSFET is exposed to the overall ESD voltage drop directly.

Low-noise amplifier (LNA) is an electronic amplifier used to amplify very weak signals. LNA is the simple block in receiver most front ends .Using an LNA, the effect of noise from subsequent stages of the receive chain is reduced by the gain of the LNA, while the noise of the LNA itself is injected directly into the received signal. LNA is a part that amplifying the signal plus bring a minimal amount of noise to the signal.[14]

In other hand, wideband is a term usually used in communication to describe a wide range of frequencies in a spectrum. A wideband amplifier is an electronic circuit providing constant amplification with a ratio of its low corner frequency to its high corner frequency of more than an octave. Wideband is usually used in wireless application.[13]