SNM Analysis of HEMT Based Highly Stable SRAM Cell

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Abstract

This paper presents the analysis of Static Noise Margin (SNM) of HEMT based SRAM cell design for three deferent frequencies. The results obtained through our proposed design are compared and contrasted with reported data for the validation of our design approach. The Static Noise Margin (SNM) of HEMT based SARM cell was 355mV, 310mV and 245mV for frequency 5GHz, 20GHZ and 50GHZ respectively. The design and analysis of HEMT SRAM cell was done using TCAD tool. The high SNM is achieved for low frequency, which increases the stability of the proposed design.

Keywords

SRAM, SNM, HEMT, TCAD Tool, Stability

1. Introduction

The High Electron Mobility Transistor (HEMT) has a capacity to build up the prerequisites for High Momentum and Low Power ICs due to its High remove recurrence and high trans-conductance and diminished short channel impacts [1]. There are two fundamental kinds of semiconductor recollections for example SRAM and DRAM. Standard 6T SRAM cell gives quick admittance to information however it is actually enormous. It is utilized for little stockpiling and for quick store memory. On opposite side modern standard 1T1C DRAM cell is more modest than SRAM yet its speed is slow. Measure commonly utilized for principle memory [2-5]. From the assortment of advances which might be applied to start of semiconductor recollections, inside that the CMOS innovation has arisen as the prevailing innovation in manufacture of recollections like centralized computer, reserve, cushion, scratch-cushion, iphone, supercomputer, extra room of shopper hardware, and so forth, however GaAs innovation based memory configuration became famous because of its high velocity, low force scattering and capacity to work at high frequencies [5]. The requirement for rapid recollections has lead to the improvement of Gallium-Arsenide (GaAs) Random-Access Memories (RAMs). In this administrative work have been done for high solidness HEMT based SRAM Cell design.

2. Proposed HEMT SRAM Cell Design

Density, power consumption, and read and write access time are all typical design requirements for SRAM.To reduce circuit access time, pull up and pull down delays, just a single supply voltage should be used.In the proposed HEMT SRAM cell configuration, some essential features are taken into account.Figure 1 illustrates a schematic of the proposed high-speed HEMT-based SRAM cell.The SRAM cell is made up of four n-HEM and two p-HEMT transistors. Figure 1 shows how the source–

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gate back biasing in p-HEMTs, M1 and M2, is employed as a subthreshold current reduction circuit to minimize the cell's power dissipation.The cross-coupled M3 and M4 latch creates a healthy storage element with low static power dissipation. One write-only port is implemented by transistor M5, while a read-only port is implemented by transistor M6.

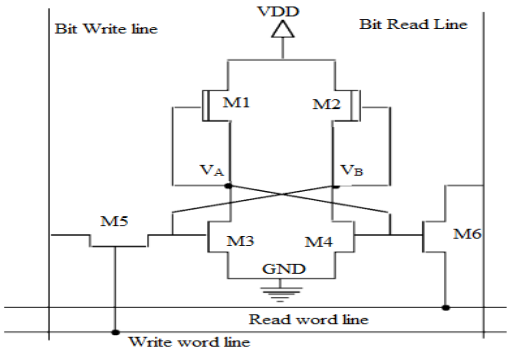

Figure 1: Proposed HEMT based SRAM cell

3. Result and Simulation

The results of the Static Random Access Memory (SRAM) cell designed with HEMT model are compared with reported results in the literature for the validation purpose as shown in Figure 2. We evaluated the reading and writing Static Noise Margin (SNM). The simulations of SRAM cell have been done using TCAD tool.

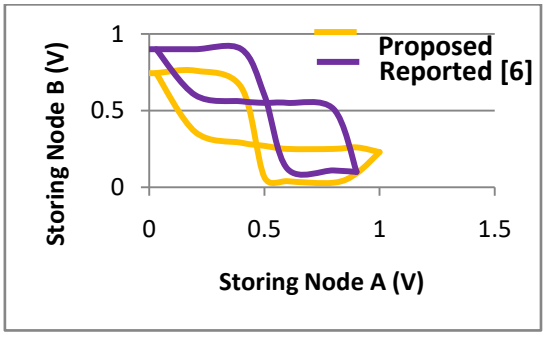

Figure 2:SNM Coparison with proposed and reported paper [6]

The simulation results of SRAM cell with various frequencies for both read and write operations have been carried out as shown in Figure 3. Significant increase in the SNM of proposed HEMT based SRAM cell design indicates improvement in the results obtained.

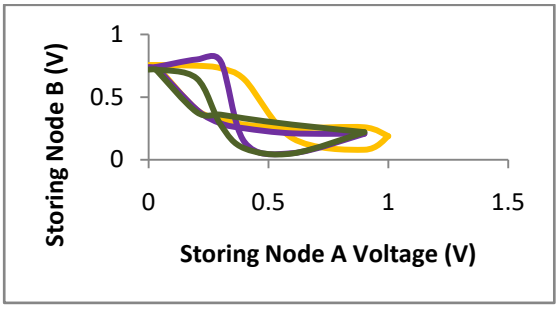

Figure 3:RSNM of HEMT SRAM cell with 5GHZ, 20 GHZ and 50 GHZ frequencies

Table 1
SNM Calculation of HEMT SRAM cell

Parameter	f = 5GHZ	f = 20GHZ	f = 50GHZ	Reported data
StaticNoiseMargin (mV)	355mV	310	245	238 [6]
Read SNM (mV)	305mv	281	208	194 [1]
Write SNM (mV)	416mv	378	267	200 [1]

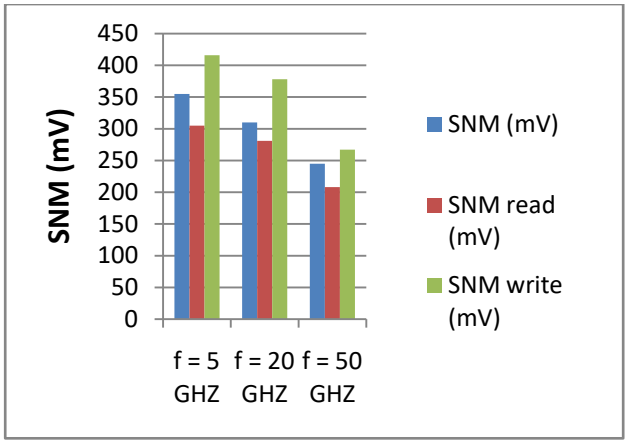

Figure 4: SNM, RSNM and WSNM vs. frequencies

The HEMT is high frequency transistor and at the higher frequencies HEMT based SRAM cell shows great Static Noise Margin (SNM), RSNM and WSNM is as shown in Figure 4. For frequency f = 5 GHZ the value of write SNM is shows best results while at frequency f = 20 GHZ SNM is slightly less than with compared to f = 5 GHZ.

4. Conclusion

In this work design and analysis of Static Random Access Memory (SRAM) cell have been carried out for evaluation ofSNM. The simulation results have shown that our proposed HEMET based SRAM cell has been achieved significant increase in SNM over conventional SRAM cell, which validate our design approach. We compared and construct results of our proposed cell with previous reported data. The Static Noise Margin (SNM), Read Static Noise margin (RSNM) and Write Static Noise Margin (WSNM) shows excellent results over reported data.

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