RESEARCH ON MEMRISTIVE- AND MEMCAPACITIVE-BASED GATE-LESS MEMORY ARRAYS

By

Ahmed Adel Mohamed Emara Kassem

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfilment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Electronics and Communications Engineering

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Under the Supervision of

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TITLE OF THESIS:

Research on Memristive- and Memcapacitive-based Gate-less Memory Arrays

Key Words:
Memristor; Memcapacitor; Gate-less memory array; Sneak paths

Summary:
This work aims to explore the properties of emerging devices as memristors and memcapacitors. The use of these devices as memory cells in memory applications is investigated as well as the techniques used for information extraction. The work helps to better solve the problems of sneak paths in gate-less arrays, coupling capacitance between selection bars and non-uniformity of data distribution in the array. It also gives a guide to solving selection bar resistance effect for future work.

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Dedication

To

my parents:

Dr Adel

and

Dr Neamat,

my sister:

Ayah,

and

my brothers:

Abdel Rahman,

and

Ibrahim.

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List of Symbols and Abbreviations

Symbols	Description
v	Voltage.
i	Current.
q	Charge.
ϕ	Magnetic flux.
R	Resistance.
G	Conductance.
C	Capacitance.
L	Inductance.
t	Time.
M	Memristance.
W	Memductance.
R_{on}	Low resistance state.
R_{off}	High resistance state.
D	Device width.
w	Doped region width.
μ_v	Dopants mobility.
σ	Charge time integral.
ρ	Magnetic flux time integral.
α	Device voltage order.
β	Device current order.
Ξ	Device complexity metric.
Z	Impedance.
U	Potential energy.
F	Force.