International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 08, August-2024

linearity, bandwidth, and power consumption than typical analogue circuits.. [8] A simulation study of memristor-based digital logic circuits is presented, including discussions of the design and simulation approaches employed, as well as simulation results proving the circuits' functionality and performance is high.

III.PROPOSED CODE CONVERTERS IMPLEMENTATION

A. BINARY TO GRAY code converter:

In a binary to Gray code converter, a fundamental operation involves determining the Gray code bits based on the binary input bits. The converter receives a binary input consisting of multiple binary digits, representing a numerical value in binary format. Conversion: The converter processes the binary input and generates the corresponding Gray code output, where each digit is transformed according to the rules of Gray code conversion. Memristor-based logic gates and circuits are employed to perform the conversion operation. These circuits are configured to implement the necessary logical transformations to convert binary input to Gray code output. Result is depicted in Table.1

Table.1 : Binary to Gray Truth Table

BINARY				GRAY CODE			
b3	b2	b1	b0	g3	g2	g1	g0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0

B. GRAY TO BINARY:

In a Gray code to binary converter, combining specific Gray code bits to generate binary outputs is a key operation. The converter receives a Gray code input consisting of multiple digits, representing a numerical value in Gray code format. The converter processes the Gray code input and generates the corresponding binary code output, where each digit is transformed according to the rules of Gray code to binary code conversion. Memristors can be configured in arrays to serve as OR gates. By controlling the resistance states of these

[11] investigates the use of memristors in digital circuit design to minimise power dissipation. It presents design techniques and experimental findings that show power reductions in terms of both dynamic and static power .

Table.2 : Gray to Binary Truth Table

memristors, the OR gate array logically combines Gray code bits to produce corresponding binary outputs which shown in Table.2.

GRAY CODE				BINARY			
g3	g2	g1	g0	b3	b2	b1	b0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0

C .BCD TO EXCESS-3:

They are essential components in digital systems where data needs to be transformed from BCD format to Excess-3 code format. The Excess-3 code is a non-weighted code used to represent decimal digits, where each digit is represented by adding 3 to its corresponding BCD code. The converter processes the BCD input and generates the corresponding Excess-3 code output, where each digit is incremented by 3 compared to its BCD equivalent. Memristor-based logic gates are used to perform the conversion operation. These logic gates are configured to implement the required arithmetic operations to add 3 to each BCD digit.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 08, August-2024

Table.3 : BCD to Excess-3 Truth Table

BCD				Excess-3			
A	B	C	C	w	x	y	z
0	0	0	0	0	0	1	1
0	0	0	1	0	1	0	0
0	0	1	0	0	1	1	1
0	0	1	1	0	1	1	0
0	1	0	0	0	1	1	1
0	1	0	1	1	0	0	0
0	1	1	0	1	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	1	0	1	1
1	0	0	1	1	1	0	0
1	0	1	0	X	X	X	X
1	0	1	1	X	X	X	X
1	1	0	0	X	X	X	X
1	1	0	1	X	X	X	X
1	1	1	0	X	X	X	X
1	1	1	1	X	X	X	X

D. EXCESS-3 TO BCD:

The converters are crucial components in digital systems where data needs to be transformed from Excess-3 code format to BCD format. The Excess-3 code is a non-weighted code used to represent decimal digits by adding 3 to their corresponding BCD code. The converter processes the Excess-3 input and generates the corresponding BCD output, which is shown in Table.4 where each digit is decremented by 3 to obtain its BCD equivalent. Implementation Using Memristors: These gates are configured to implement the necessary arithmetic operations to subtract 3 from each Excess-3 digit.

Table.4 : Excess-3 to BCD Truth Table

Excess-3				BCD			
w	x	y	z	A	B	C	D
0	0	0	0	X	X	X	X
0	0	0	1	X	X	X	X
0	0	1	0	X	X	X	X
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	1
0	1	0	1	0	0	1	0
0	1	1	0	0	0	1	1
0	1	1	1	0	1	0	0
1	0	0	0	0	1	0	1
1	0	0	1	0	1	1	0
1	0	1	0	0	1	1	1
1	0	1	1	1	0	0	0
1	1	0	0	1	0	0	1
1	1	0	1	X	X	X	X
1	1	1	0	X	X	X	X
1	1	1	1	X	X	X	X

IV. RESULTS AND DISCUSSION

The works is carried out as follows. Simulated all the code converters using Memristor technology, implemented using LT-Spice tool. The design and corresponding simulated results are provided below with tables providing their performance analysis. Fig 3,4,5,6,7,8,9,10 figures shows the implementation and output waveforms of the converters.

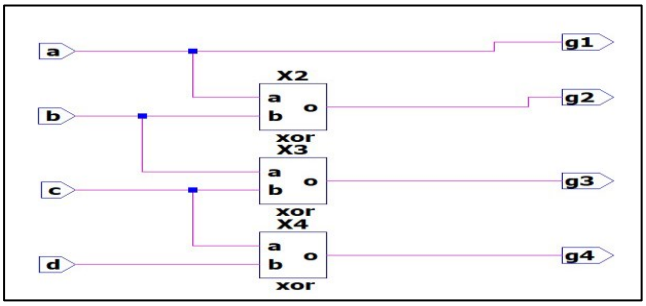

Fig.3 Implementation of Binary to Gray converter

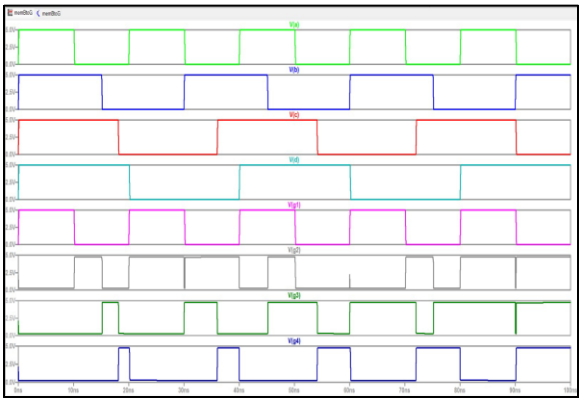

Fig.4 Output waveform of Binary to Gray converter

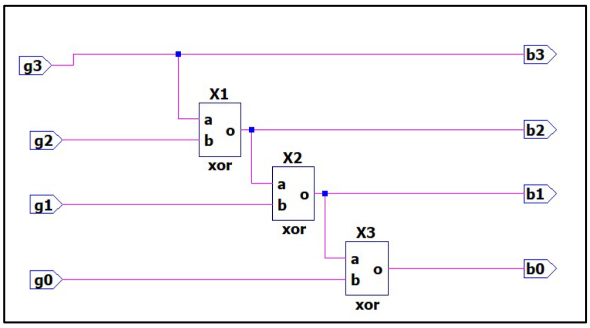

Fig.5 Implementation of Gray to Binary converter

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 08, August-2024

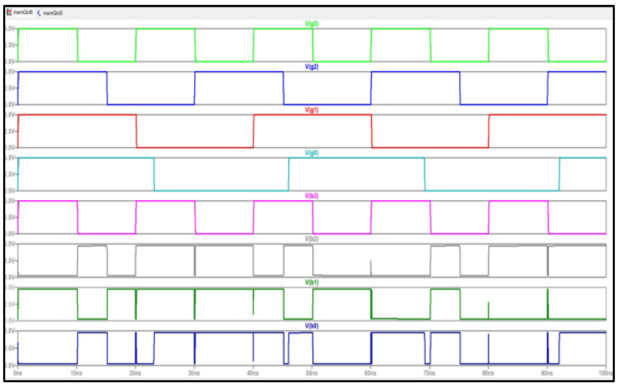

Fig.6 Output waveform of Gray to Binary converter

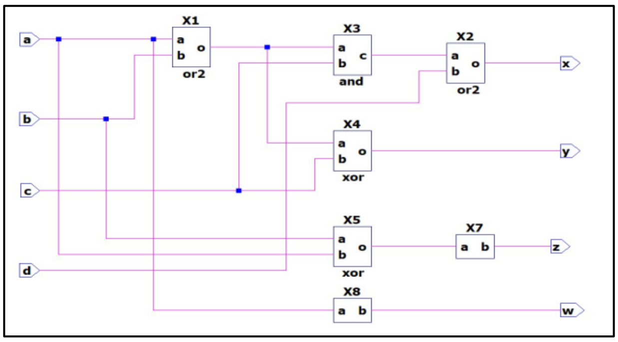

Fig.7 Implementation of BCD to Excess-3 converter

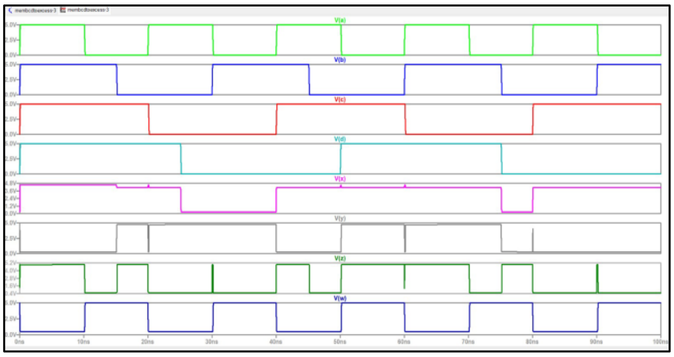

Fig.8 Output waveform of BCD to Excess-3 converter

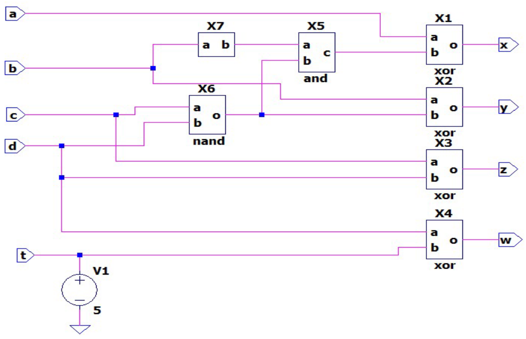

Fig.9 Implementation of Excess-3 to BCD converter

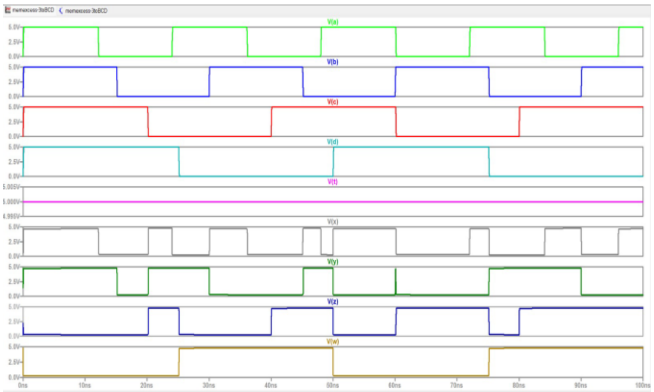

Fig.10 Output waveform of Excess-3 to BCD converter

Table.5: Binary to Gray

Parameters	CMOS	Memristor
No of transistors	48	24
Power dissipation	8.68 fW	5.64 fW

Table.6: Gray to Binary

Parameters	CMOS	Memristor
No of transistors	48	24
Power dissipation	8.68 fW	3.84 fW

Table.7: BCD to Excess-3

Parameters	CMOS	Memristor
No of transistors	59	29
Power dissipation	639.1 microW	1fW

Table.8: Ecxess-3 to BCD

Parameters	CMOS	Memristor
No of transistors	76	38
Power dissipation	746.7pW	80.42 fW