MIT World Peace University

Digital Electronics and Computer Architecture
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4 Bit Adder and Subtracter using IC 7483

Practical Report

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Contents

1 Problem Statement

To design and implement 4 bit Adder and Subtractor using IC 7483 parallel adder.

2 Components Used

1. 2 1.5 V AA Batteries or 3 Volt Power Source

2. DIP Switch SPST x 4"

3. DIP Switch DPST"

4. Quad XOR gate"

5. 4-Bit Adder"

6. 5 Red LED"

7. 220 Ω Resistor"

8. 4 Blue LED"

9. 4 Orange LED"

3 Truth Table of Involved Truth Tables

3.1 4 bit Full Adder

Cin	A				B				Sum				Carry
	A3	A2	A1	A0	B3	B2	B1	B0	S3	S2	S1	S0	Cout
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	1	0	0	1	0	0
0	0	0	1	0	0	0	1	0	0	1	0	0	0
0	0	0	1	1	0	0	1	1	0	1	1	0	0
0	0	1	0	0	0	1	0	0	1	0	0	0	0
0	0	1	0	1	0	1	0	1	1	0	1	0	0
0	0	1	1	0	0	1	1	0	1	1	0	0	0
0	0	1	1	1	0	1	1	1	1	1	1	0	0
0	1	0	0	0	1	0	0	0	0	0	0	0	1
0	1	0	0	1	1	0	0	1	0	0	1	0	1
0	1	0	1	0	1	0	1	0	0	1	0	0	1
0	1	0	1	1	1	0	1	1	0	1	1	0	1
0	1	1	0	0	1	1	0	0	1	0	0	0	1
0	1	1	0	1	1	1	0	1	1	0	1	0	1
0	1	1	1	0	1	1	1	0	1	1	0	0	1
0	1	1	1	1	1	1	1	1	1	1	1	0	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1

Figure 1:

3.2 Truth Table of 3 Bit Full Subtractor

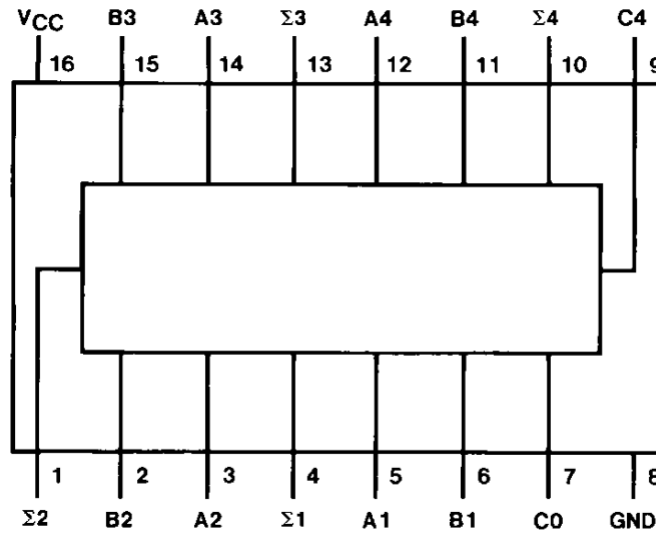| Inputs			Outputs	
A	**B**	**Borrow In**	**Diff**	**Borrow**
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

4 Pin Diagrams of Used ICs

4.1 Pin Diagram of IC7486

7486 Quad 2-input ExOR Gates
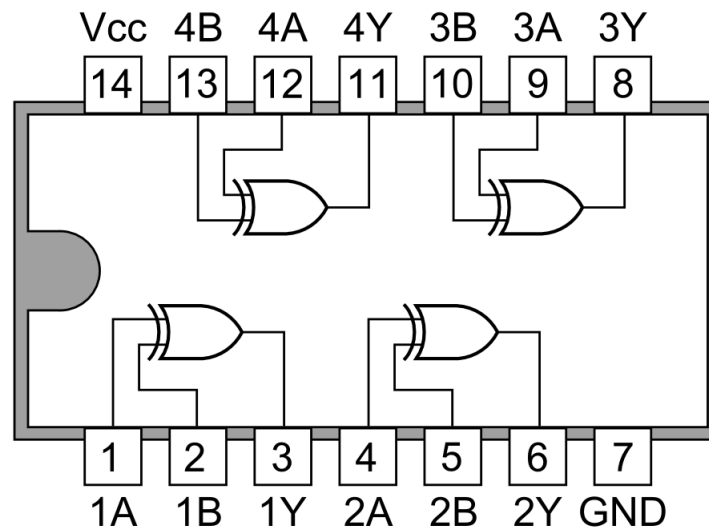
4.2 Pin Diagram of IC74283

5 Theory

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5.1 What is adder and Subtractor

5.2 Adder

Adders are the combinatorial circuits which are used to add two binary numbers. The nature of the adders chosen depends on the characteristics of the binary numbers which need to be added. Say for example, if one needs to add two single bit binary digits, then one can use half adder while if there is an additional carry which needs to be added along with them, then one may resort to the use of full adder.

5.3 Subtractor

Subtraction of two binary numbers can be accomplished by adding 2's complement of the subtrahend to the minuend and disregarding the final carry if any. If the MSB bit in the result of addition is a '0'. then the result of addition is the correct answer. If the MSB bit is a '1'. , this implies that the answer has a negative sign. The true magnitude, in this case, is given by 2's complement of the result of the addition.

5.4 Parallel Adder

what if we want to add a binary number which has multiple bits in it. In such a case, the need arises to use a parallel adder. Parallel adder is nothing but a cascade of several full adders. The number of full adders used will depend on the number of bits in the binary digits which require to be added.
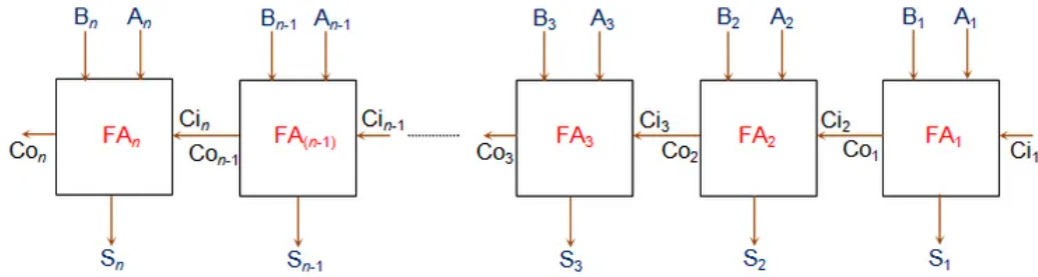
Figure 2: Parallel Adder

5.5 Serial Adder

A serial adder is abinary adder that is capable of forming sum and carry outputs for add end and augend words of greater than one bit in length.
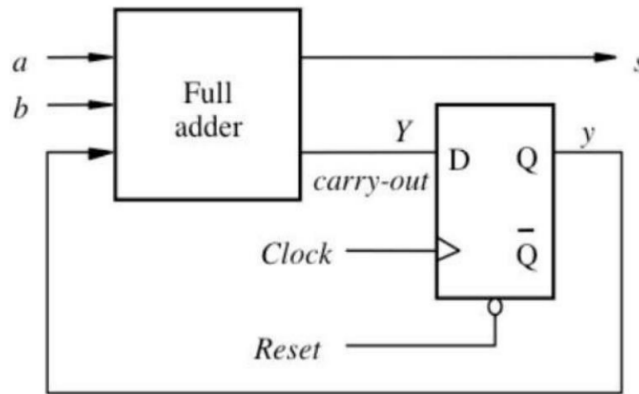

Figure 3: Serial Adder

5.6 Advantages of Parallel Adder to Serial Adder

1. A parallel Adder is faster.

2. It uses registers with parallel load capacity

3. The number of full adder circuits is equal to the number of bits in the binary adder.

4. It is a combinatioal Circuit.

5. Time required does not depend on the number of bits.

6. It is cheaper

5.7 Disadvantages of Parallel Adder to Serial Adder

1. Each adder has to wait for the carry which is to be generated from the previous adder in chain.

2. The propagation delay(delay associated with the travelling of carry bit) is found to increase with the increase in the number of bits to be added.

6 Prodecure

1. Select the Right components and place them on the breadboard.

2. Add power to the Circuit.

3. Connect the Components using breadboard wires on tinkercad according to the drawn Circuit diagram.

4. Input the numbers and Check its working.

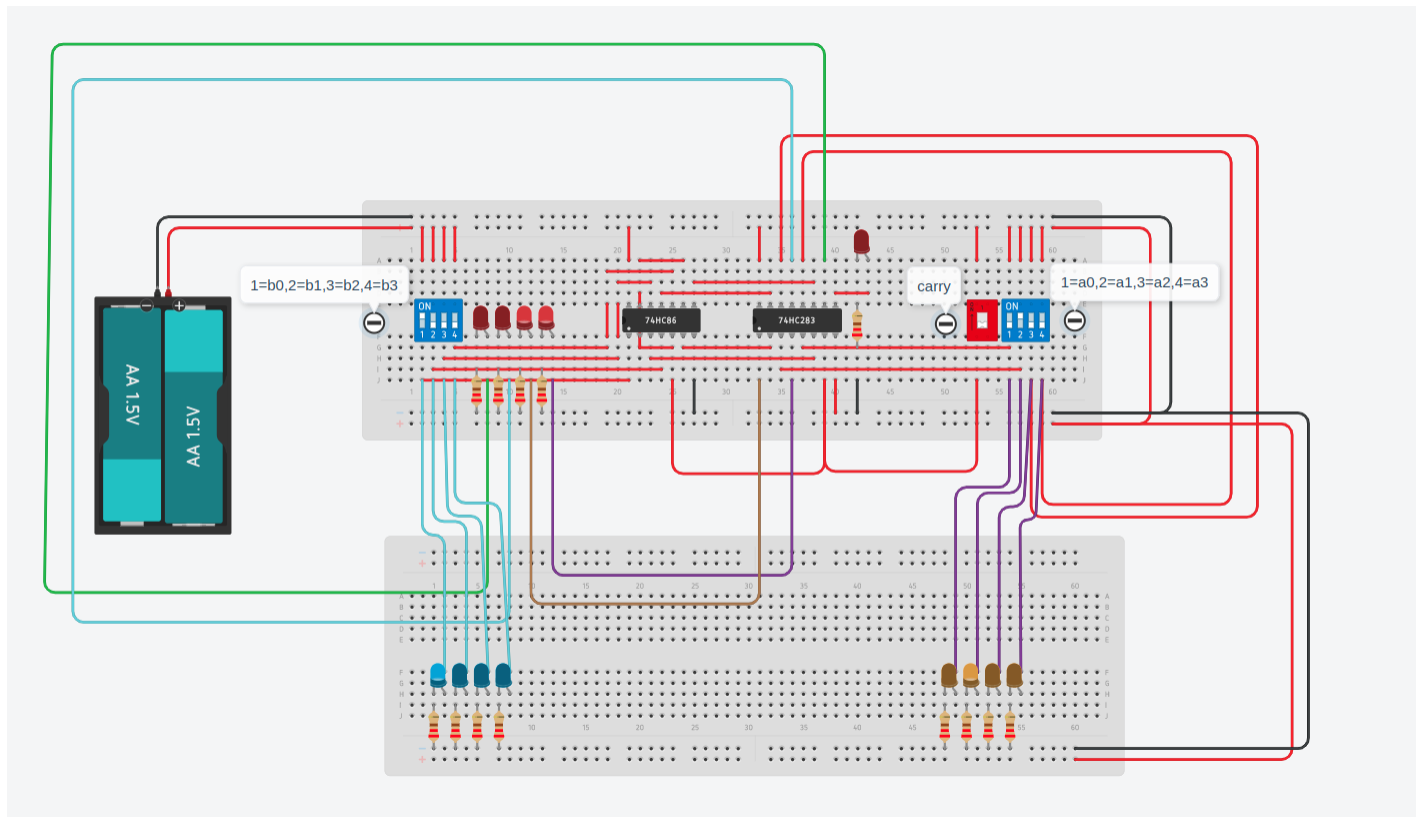# 7 Circuit Diagrams

7.1 Tinkercad Screenshots
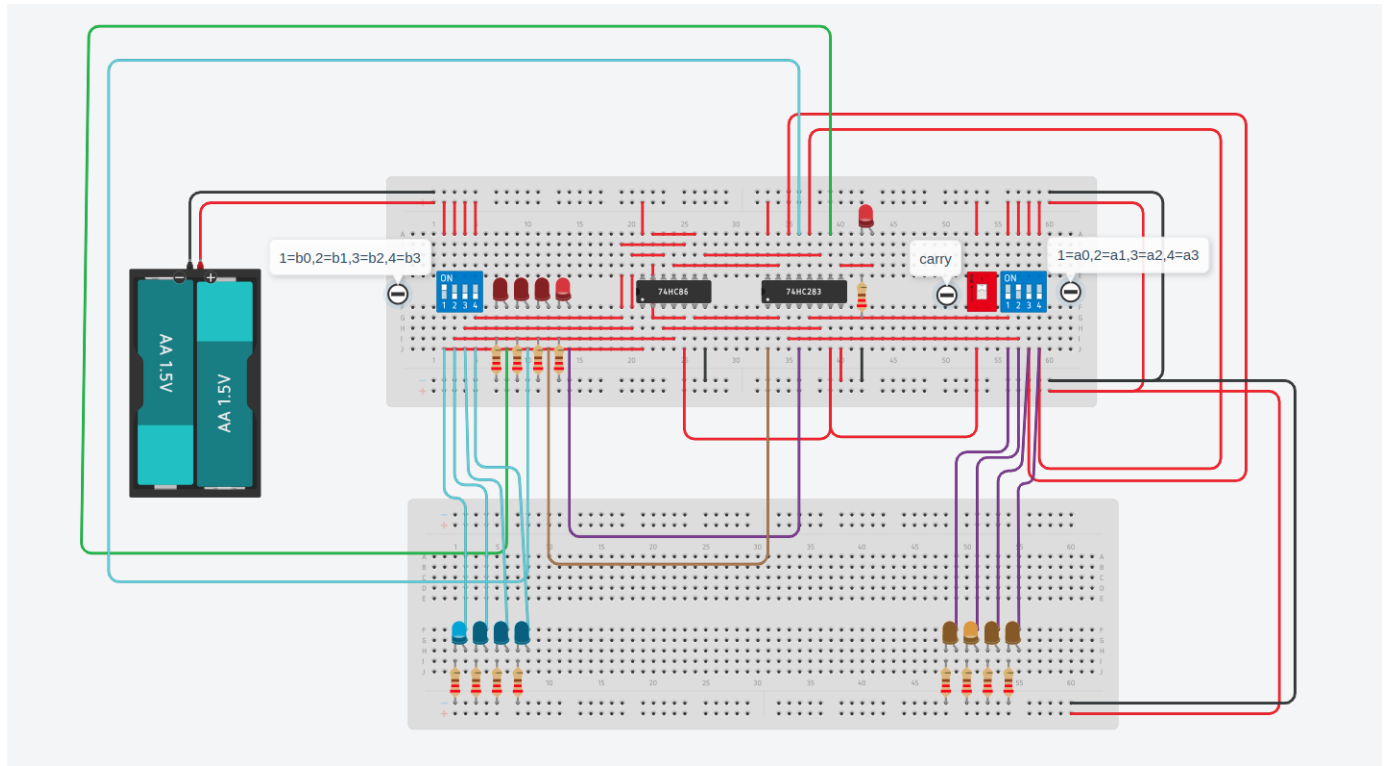

Figure 4: Adder Mode
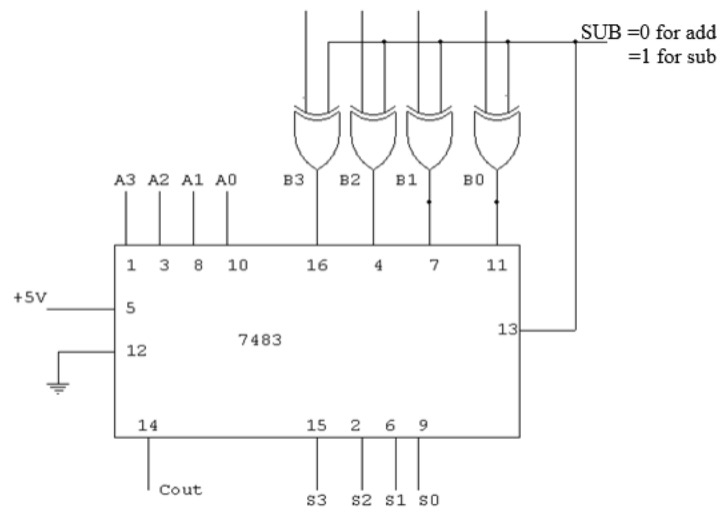
Figure 5: Subtractor Mode

7.2 Logic Diagram

Figure 6:

7.3 Circuit Pin Diagram

1 2 3 4 5 6

A

BAT1+

SW3

BAT1
3V

R1
220

D1
RED

R2
220

D2
RED

R3
220

SW2

SW1

BAT1+

U1_1A
U1_2A
U1_4A
U1_3B
U2_A0
U2_A1
U2_A2
U2_A3
D3_C
U2_S3
U2_COUT
U1_1B
BAT1-

B

BAT1-

C

BAT1+

U1

1A
1B
VCC
1Y

2A
2B
2Y

3A
3B
3Y

4A
4B
4Y
GND

U2

A0
A1
B1
A2
B2
A3
B3
CIN
VCC
S0
S1
S2
S3
COUT
GND
B0

D3
RED

D4
RED

R4
220

D5
RED

R5
220

D3_C
U2_A0

U2_A1

U2_A2
U2_S3
U2_A3
U2_COUT
U1_1A
U1_2A
U1_3B
U1_4A
U1_1B
BAT1-

D

E

Title: 4 bit adder subtractor ic 7483 &amp; 7486

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Made with Tinkercad®

D7 BLUE — R7 220 — U2_A2
D8 BLUE — R8 220 — U2_A1
D9 BLUE — R9 220 — U2_A0
D10 ORANGE — R10 220 — U1_3B
D11 ORANGE — R11 220 — U1_4A
D12 ORANGE — R12 220 — U1_2A

BAT1-

D13 ORANGE — R13 220 — R6 220 — D6 BLUE

U1_1A
U2_A3
BAT1-

Title: 4 bit adder subtractor ic 7483 &amp; 7486

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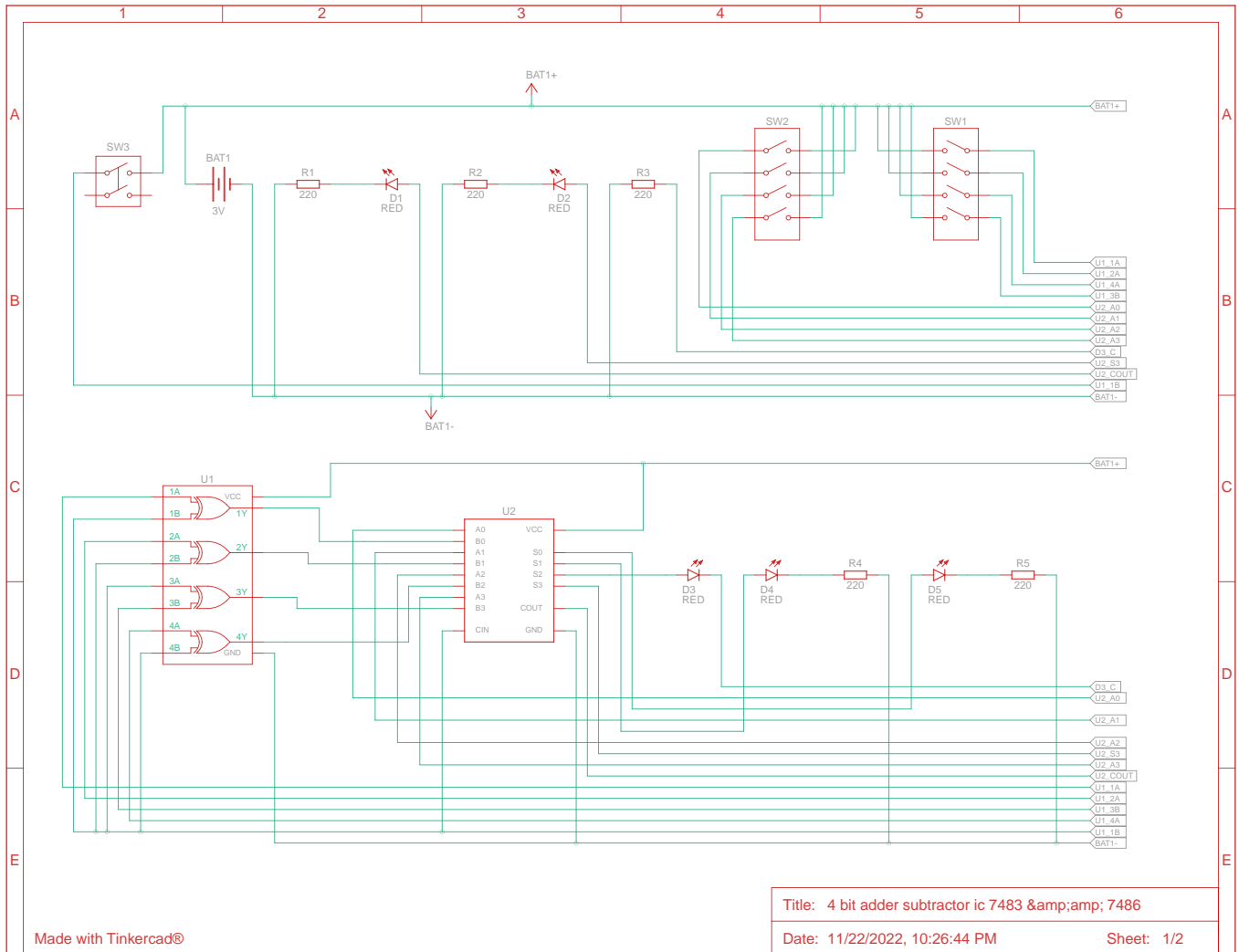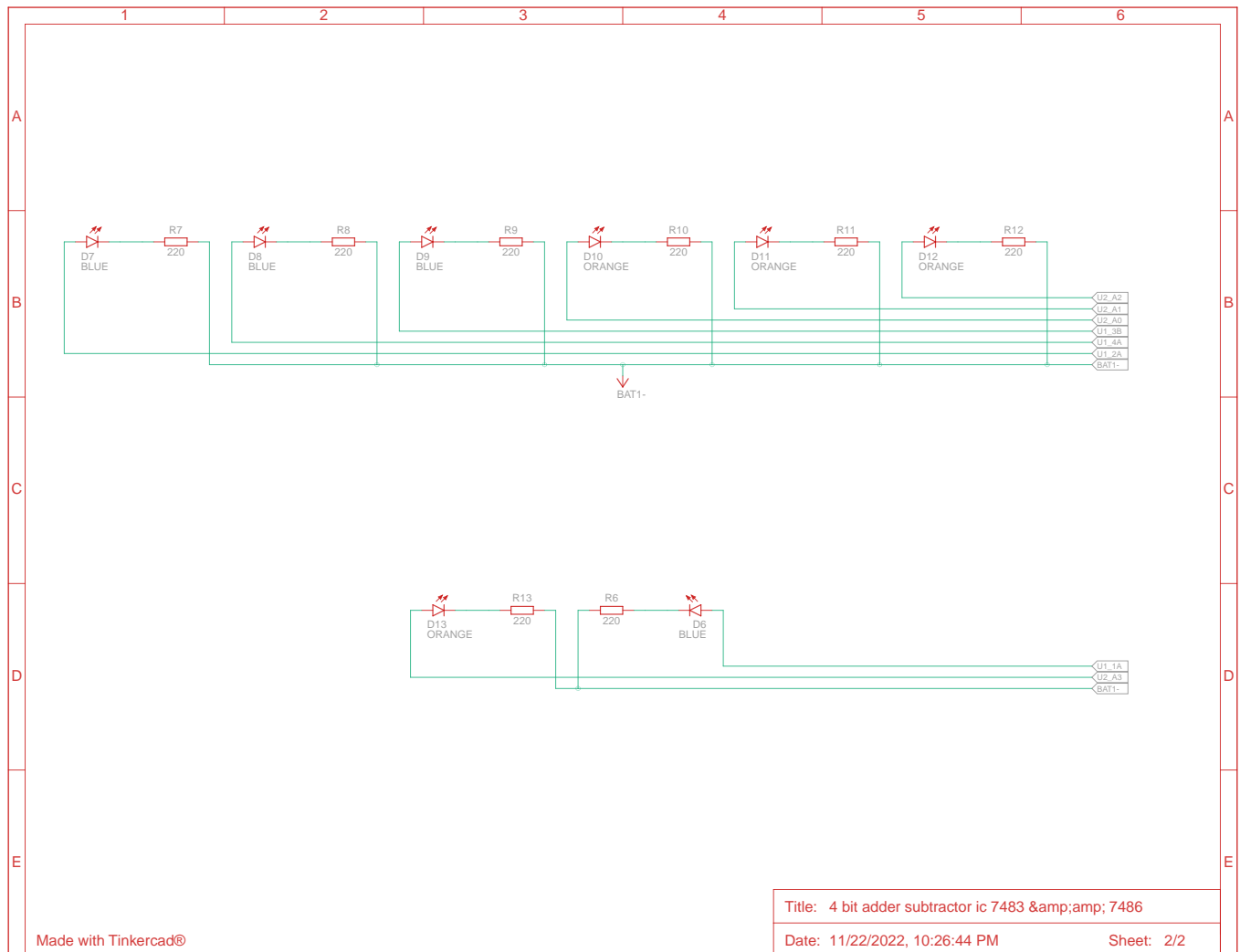
8   Applications

1. For performing arithmetic calculations in electronic calculators and other digital devices.

2. In Timers and Program Counters.

3. Useful in Digital Signal Processing.

4. Suubtractors are widely used in in computer's ALU (Arithmetic logic unit) to compute addition as well as CPU (Central Processing unit) and GPU (Graphics Processing unit) for graphics applications to reduce the circuit complexity.

5. Adder and subtractor are basically used for performing arithmetical functions like addition, subtraction, multiplication and division in electronic calculators and digital instruments.

6. Adders are used in digital calculators for arithmetic addition and devises that uses some kind of increment or arithmetic process

7. They are also used in microcontrollers for arithmetic additions, PC (program counter) and timers.

8. It is also used in processors to calculate address, tables and similar operations

9. It is also used in networking and DSP (Digital signal processor) oriented system

9   Conclusion

Thus learnt how to implement a Full adder And a subtractor using IC7483.