4-bit even parity checker

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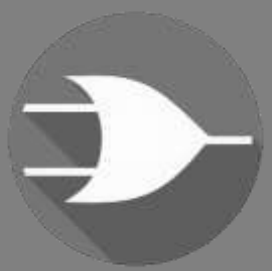


4-bit even parity checker

What Does Even Parity Mean?

Even parity refers to a parity checking mode in asynchronous communication systems in which an extra bit, called a parity bit, is set to zero if there is an even number of one bit in a one-byte data item. If the number of one bit adds up to an odd number, the parity bit is set to one.

Error Detecting Codes:

A parity bit is an extra bit included with a message to make the total number of 1's either odd or even as shown in Table (1). An error detecting code can be used to detect error during transmission.

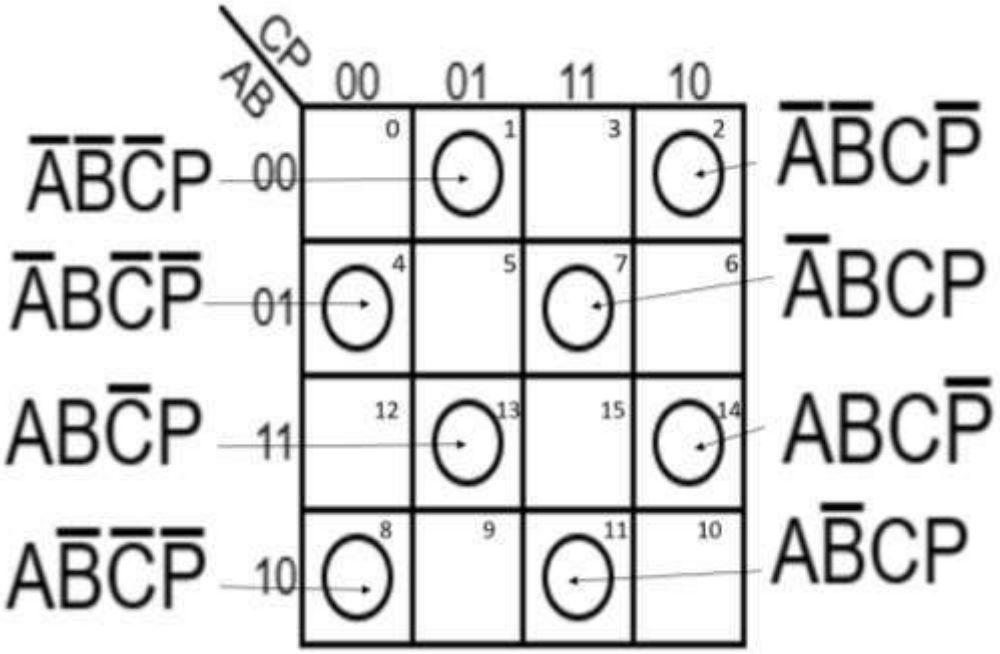
P. Bit (Even)	Message	P. Bit (Odd)	Message
0	0000	1	0000
1	0001	0	0001
1	0010	0	0010
0	0011	1	0011
1	0100	0	0100
0	0101	1	0101
..	..	..	..

Table (1)

Truth Table

4-bit received message				Parity error check C_p
A	B	C	P	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

K-map



Boolean algebra

$$\bar{A}\bar{B}\bar{C}P + \bar{A}\bar{B}C\bar{P} + \bar{A}B\bar{C}\bar{P} + \bar{A}BCP + AB\bar{C}P + ABC\bar{P} + A\bar{B}\bar{C}\bar{P} + A\bar{B}CP$$

$$\bar{A}\ \bar{B}\ (\bar{C}\ P + C\bar{P}) + \bar{A}\ B(\bar{C}\ \bar{P} + CP) + AB(\bar{C}\ P + C\bar{P}) + A\bar{B}\ (\bar{C}\ \bar{P} + CP)$$

$$= \bar{A}\ \bar{B}\ (C \oplus P) + \bar{A}\ B(\overline{C \oplus P}) + AB(C \oplus P) + A\bar{B}\ (\overline{C \oplus P})$$

$$= (\bar{A}\ \bar{B} + AB)(C \oplus P) + (\bar{A}\ B + A\bar{B})(\overline{C \oplus P})$$

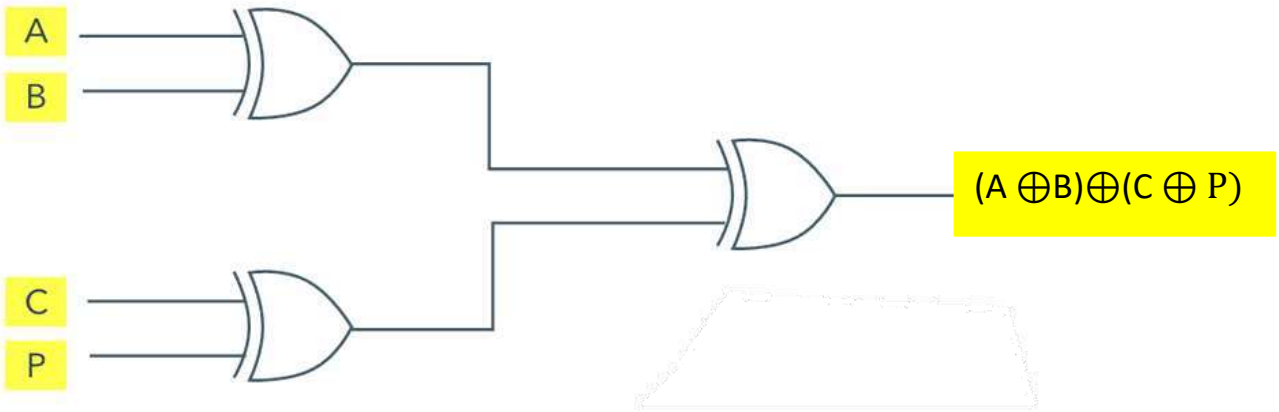
$$\overline{(A \oplus B)}\ (C \oplus P) + (A \oplus B)\ \overline{(C \oplus P)}$$

Let: $\bar{Z}\ \ Y + Z\ \ \bar{Y}$

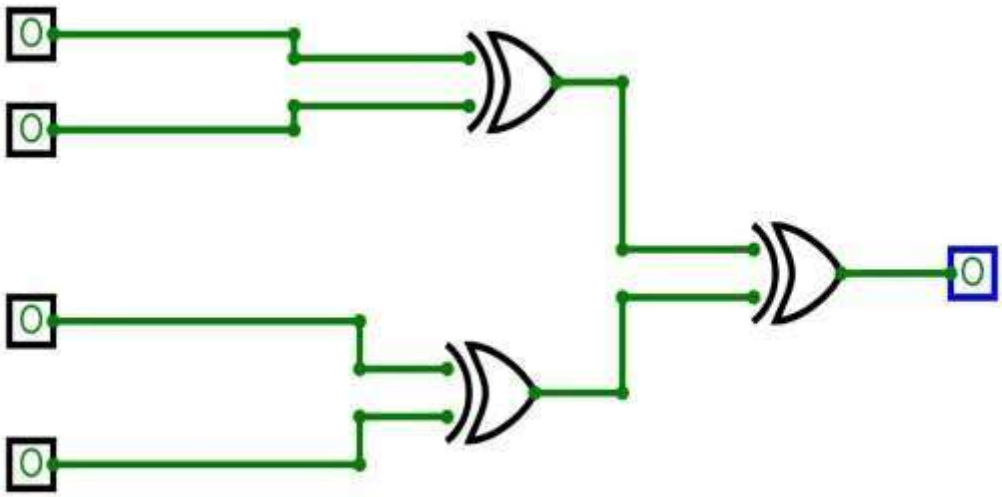
$$(Z \oplus Y)$$

By substitute we will get $= (A \oplus B) \oplus (C \oplus P)$

Logic circuit

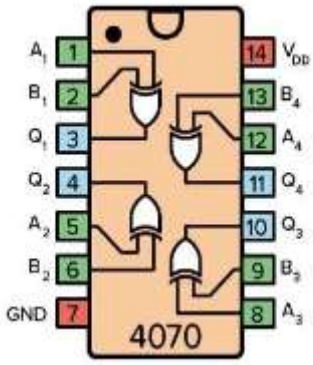


Stimulator



Components of Hardware

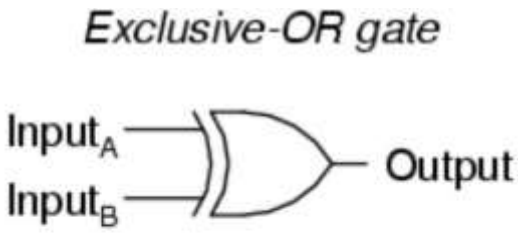
1-IC 4070

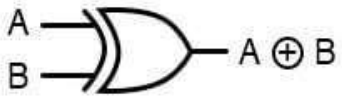


Pin Name	Pin #	Type	Description
VDD	14	Power	Supply Voltage (+3 to +15V)
GND	7	Power	Ground (0V)
A1 to A4	1, 5, 8, 12	Input	Inputs A of the four XOR gates
B1 to B4	2, 6, 9, 13	Input	Inputs B of the four XOR gates
Q1 to Q4	3, 4, 10, 11	Output	Outputs from the four XOR gates

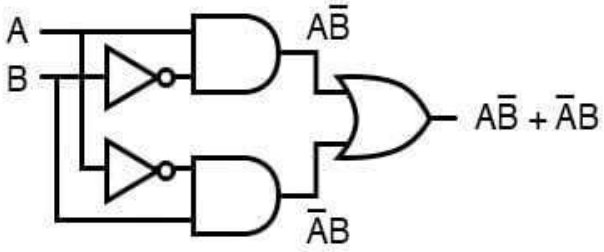
XOR gate

The XOR gate outputs HIGH if its two inputs are not equal. So if one of the inputs (both not both!) is HIGH, the output will be HIGH. It's one of the basic logic gates.





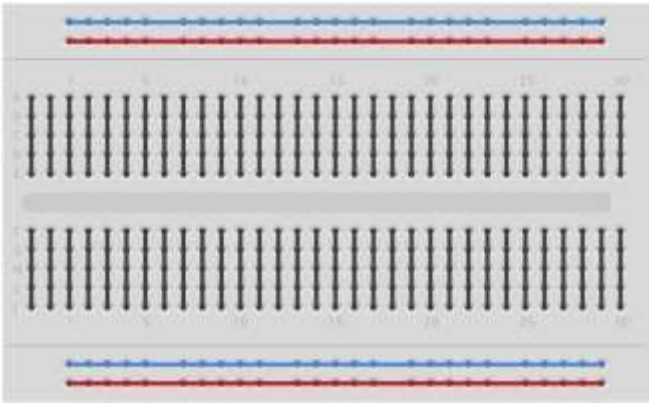
. . . is equivalent to . .



A	B	Output
0	0	0
0	1	1
1	0	1
1	1	0

$A \oplus B = A\bar{B} + \bar{A}B$

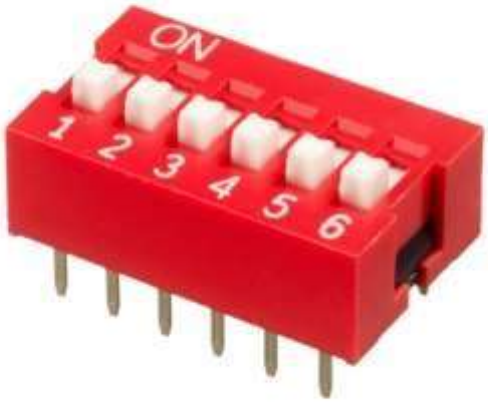
2-Breadboard



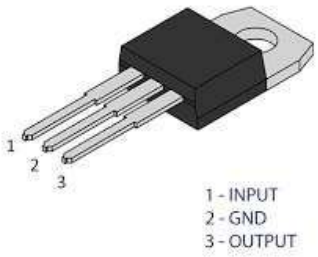
3-Male to Male Jumper Wire

4-Battery

5-Dip Switch



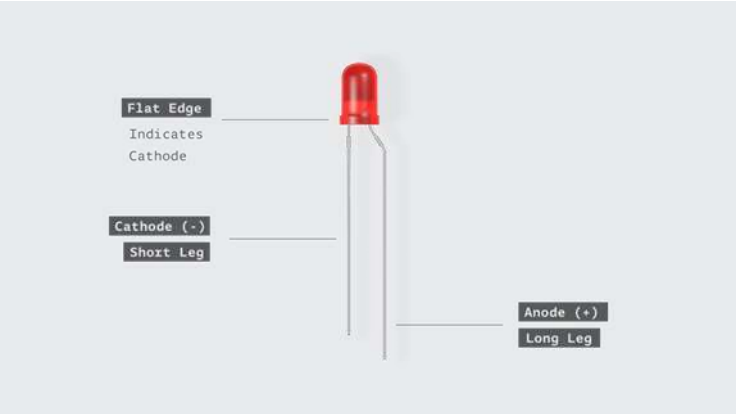
6-Voltage regulator 7805 IC



Pin Number	Pin Name	Description
1	Input (V+)	Unregulated Input Voltage
2	Ground (Gnd)	Connected it to Ground
3	Output (Vo)	Outputs Regulated +5V

7-Led

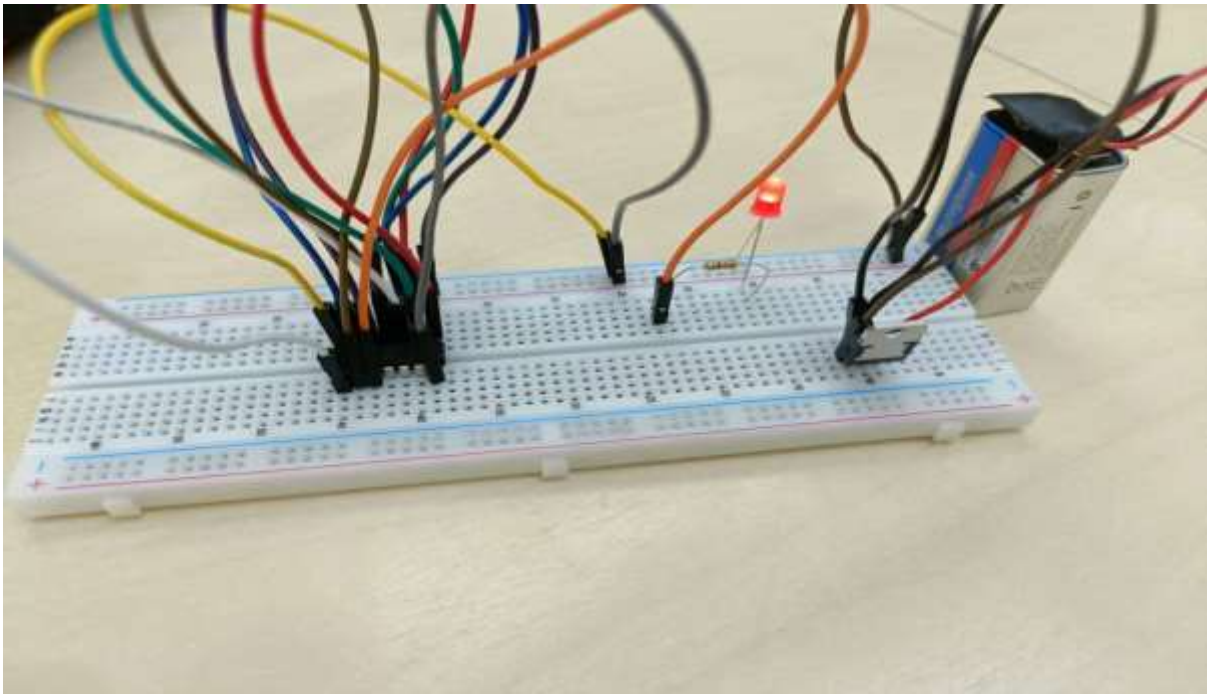
Therefore, the anode (**Long Leg**) should be toward the positive terminal of the breadboard, and the cathode (**Short Leg**) should be toward to ground (negative terminal).

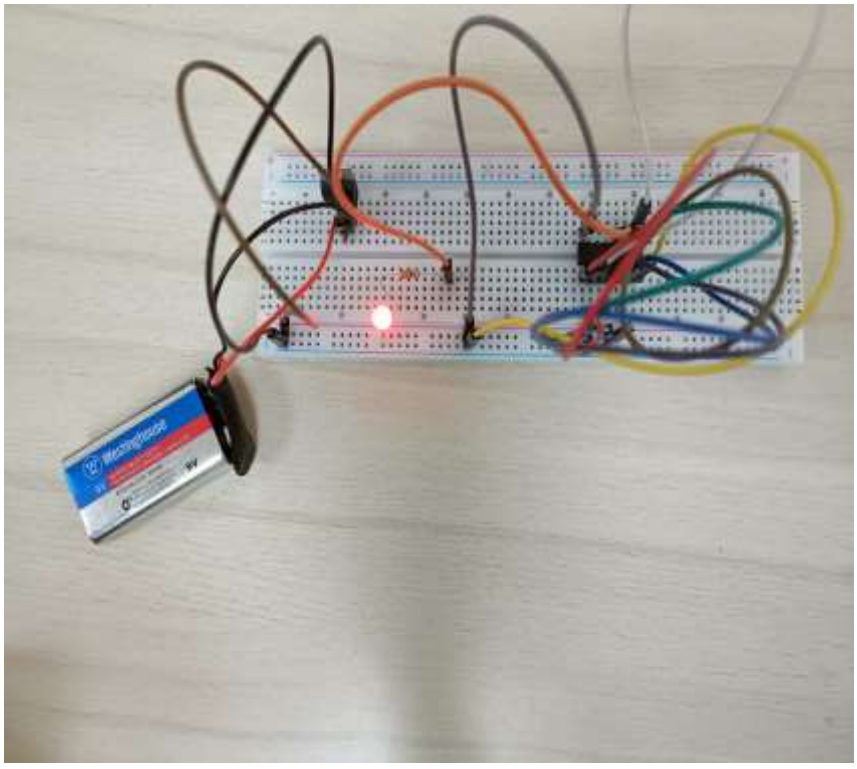


8-Resistor

Resistor are limiting current to protect a component from damage.

9-Hardware





References

IC 4070 Datasheet, Pinout Working, Truth Table, Electrical Characteristics | Homemade Circuit Projects (homemade-circuits.com)

7805 5V Voltage Regulator – FactoryForward India

Resistor - Wikipedia

Parity Generator and Parity Check - ElectronicsHub

What is Even Parity? - Definition from Techopedia