4-BIT BUS SYSTEM

Using three state buffres

Team 2:

Khaled Abdulkader Madkour

Abdulrahman Issam AbouOuf

Mohamed Nasser Elfrash

Mohamed Hussin Salama

Omar Sameh Rehan

Ahmad Hamed Akef

Omar Raafat Elezaby

Abdulla Ashraf Abdelrahman

Computer Architecture CSE3311

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1 Chapter One Introduction

This Chapter gives a quick idea about the project and briefly explains the bus system and the process of creating this project.

1.1 What is a Bus System?

The system bus is a pathway composed of cables and connectors used to carry data between a computer microprocessor and the main memory. The bus provides a communication path for the data and control signals moving between the major components of the computer system.

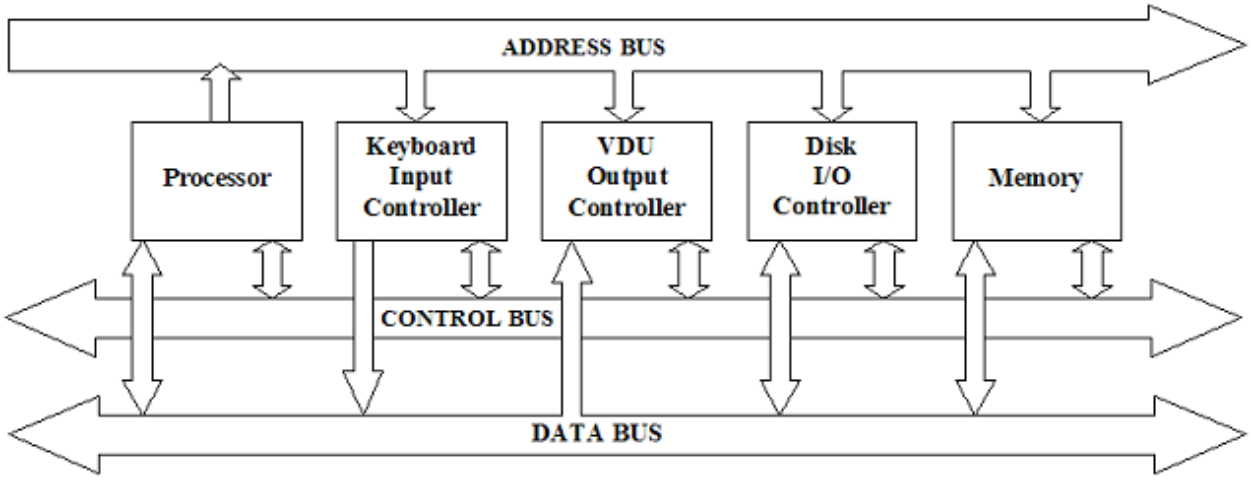

Figure 1-1 - Bus System in a Computer

1.2 Bus System Components

The system bus combines the functions of the three main buses, which are as follows:

- **The control bus** carries the control, timing and coordination signals to manage the various functions across the system.
- **The address bus** is used to specify memory locations for the data being transferred.
- **The data bus**, which is a bidirectional path, carries the actual data between the processor, the memory and the peripherals.

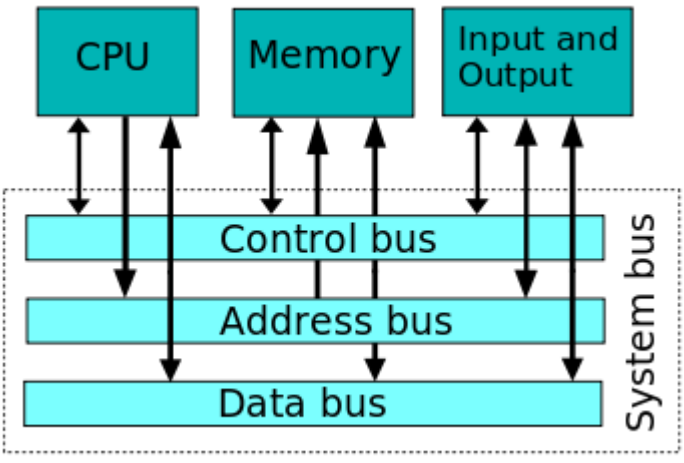

Figure 1-2 - System bus Functions

1.3 Simple Bus System

The project aims to build a simple 4-bit bus system using Multiplexes or using three “tri”- state buffer. This project uses tri-state buffers.

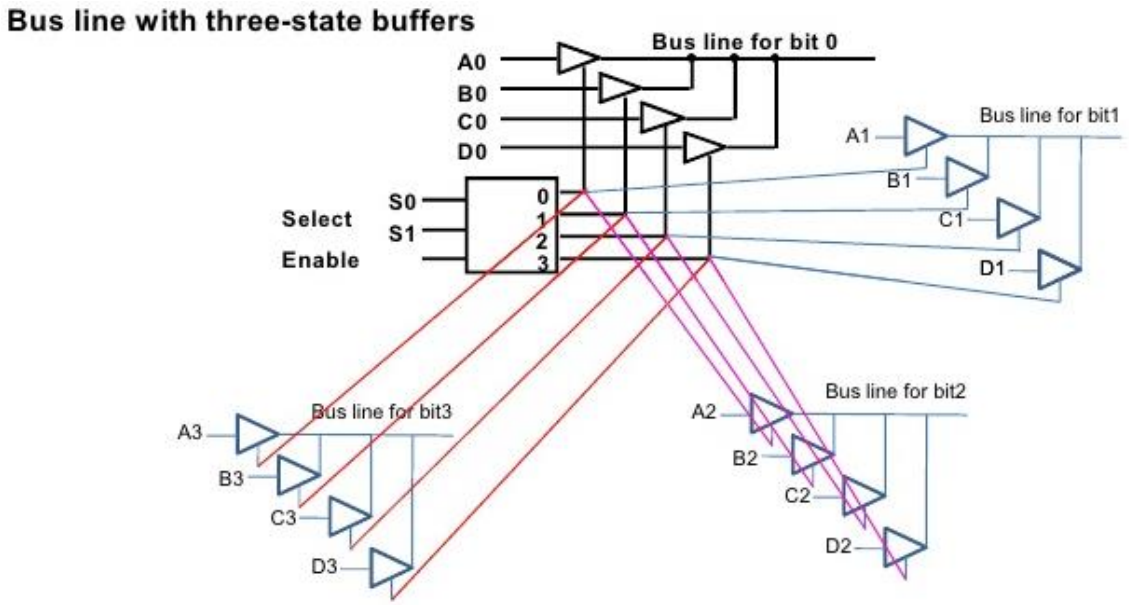

Figure 1-3 - 4 Bus system using tri-state buffers

1.4 Process of Building bus system

The next diagram shows the processes of creating the project. In the next chapters we will discuss each point in Detail.

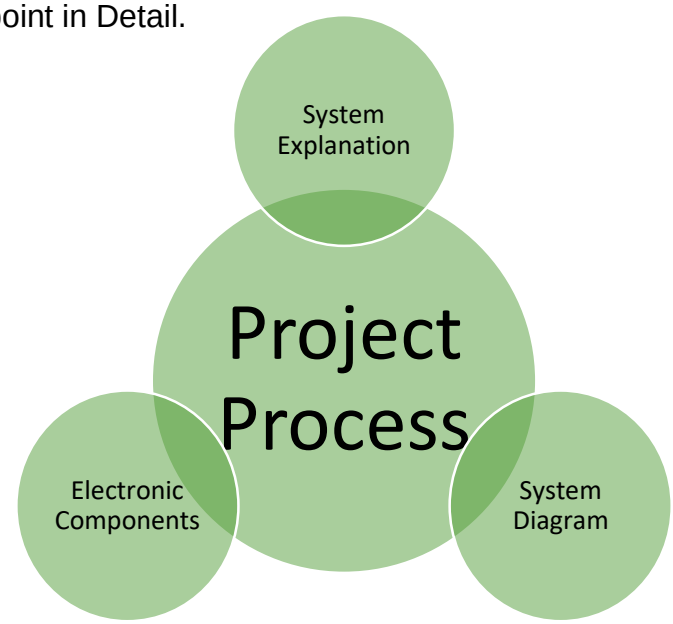

Figure 1-4 - Project Process Diagram

2 Chapter Two System Explanation and Diagram

This chapter explains the system and each block and its importance to the circuit and shows the system diagram .

2.1 4-bit Bus System Diagram

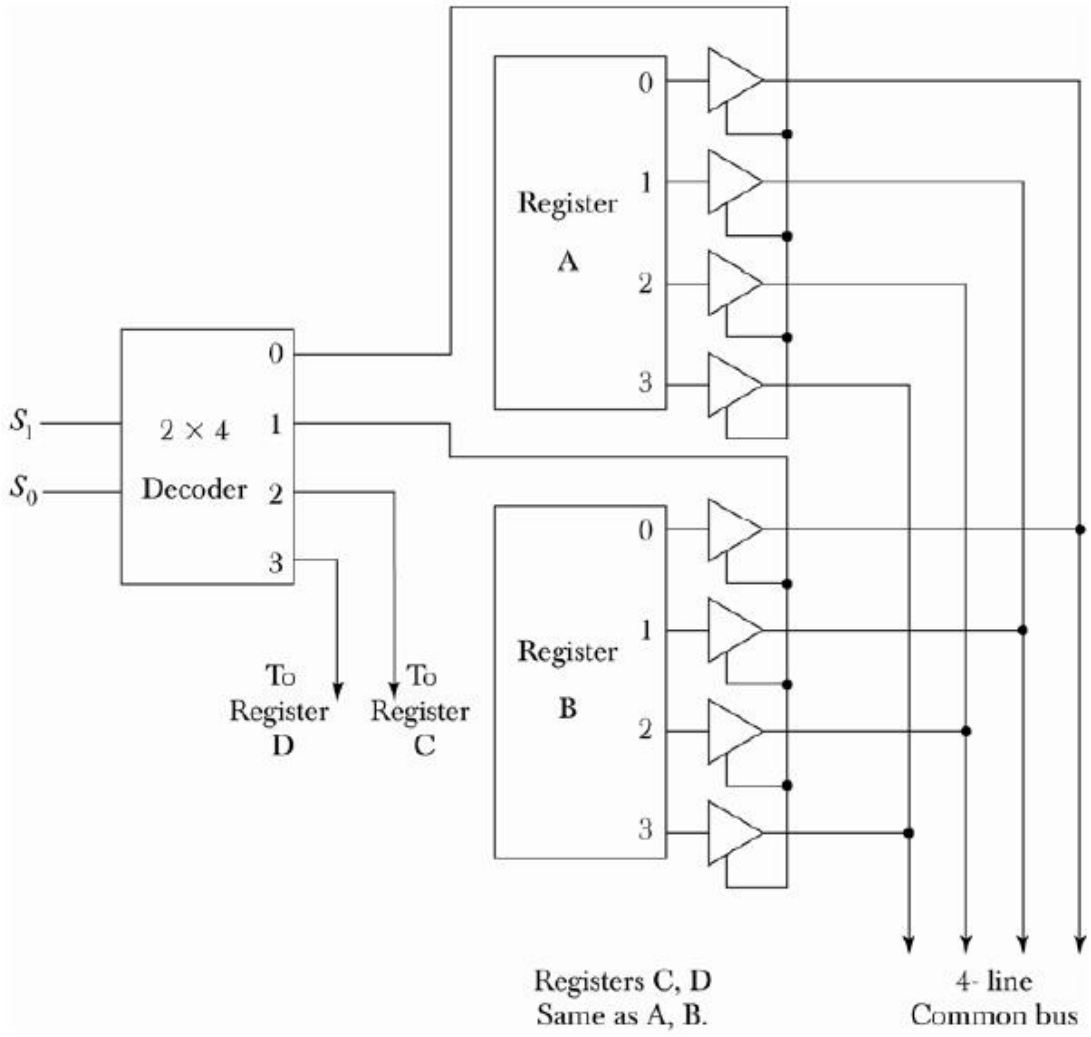

Figure 2-1 - System Diagram

2.2 System Explained

As shown in Figure 2-2, The decoder selects which register to use it as the path by enabling the tri-State buffer of this bath, then the data of the bit of the register is transferred to the path line.

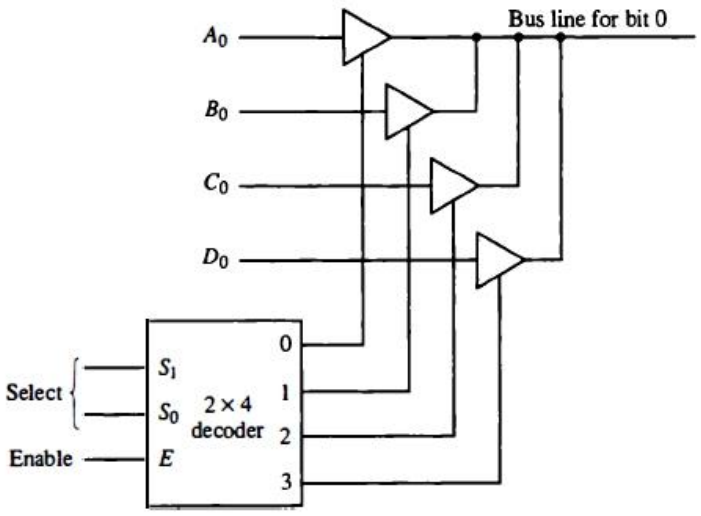

Figure 2-2 - One bit bus system

Decoder Select		Enabled Register
S0	S1	Register
0	0	A
0	1	B
1	0	C
1	1	D

Table 2-1 - Decoder Selects

In Figure 2-1, It shows the full system, with each enable enables all the four bits of the register to be transferred in the bus lines. The same goes for 32-bit and 64-bit computer Architecture.

Figure 2-3 shows how a 32-bit system data is controlled with master(register that has read and write features) and slave(register that has only write) to transfer data between CPU and memory. DEC (decoder) selects which register to be enabled. (EN).

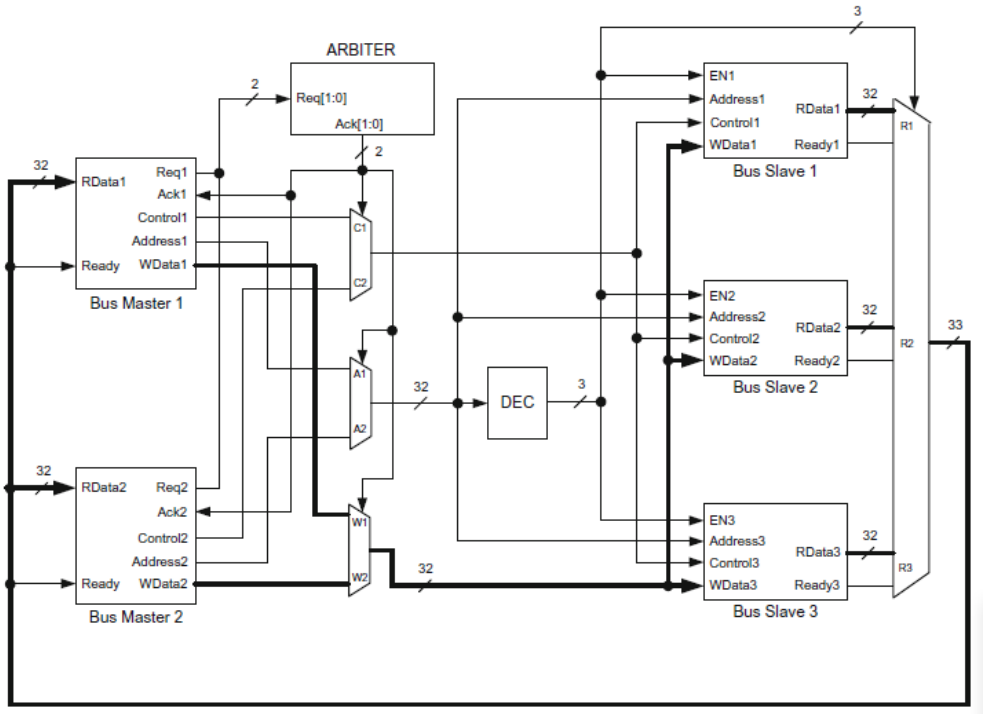

Figure 2-3 - 32 bit bus with master and slave

3 Chapter Three Electronic Components

This chapter goes to show the actual ICs used to create the system and explain each component. Then Shows the Full Circuit of the project.

3.1 Electronic Components

The circuit as was shown in Figure 2-1 needs a decoder, Three-state Buffers IC here are the Components

- Decoder 2*4 IC 74**139
- Three State Buffers(4) 74**125
- LEDs
- Wires
- Power Supply 9v
- Regulator 7805
- Resistors

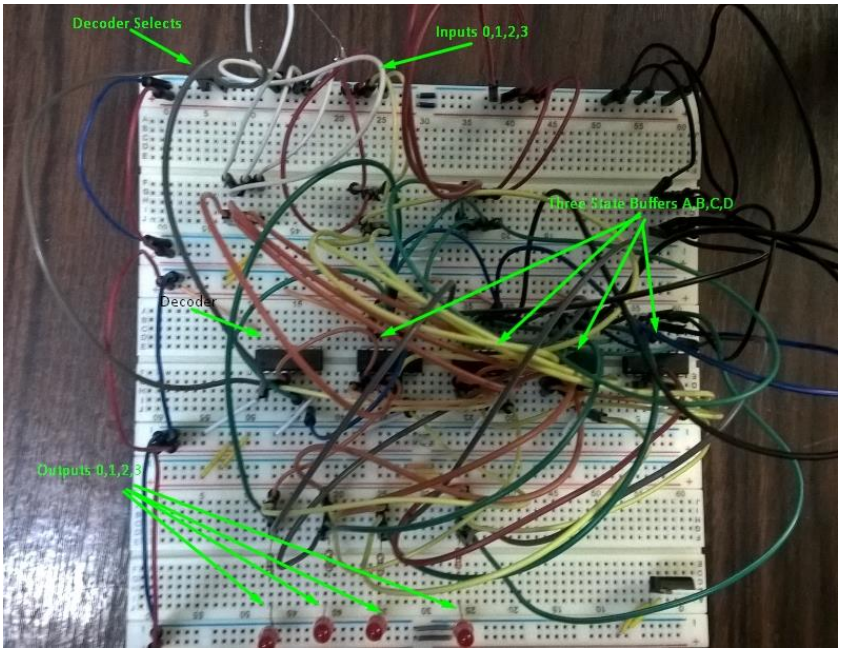

Figure 3-1 – The Circuit With its Electronic Components

3.1.1 Decoder (2x4) 74**139

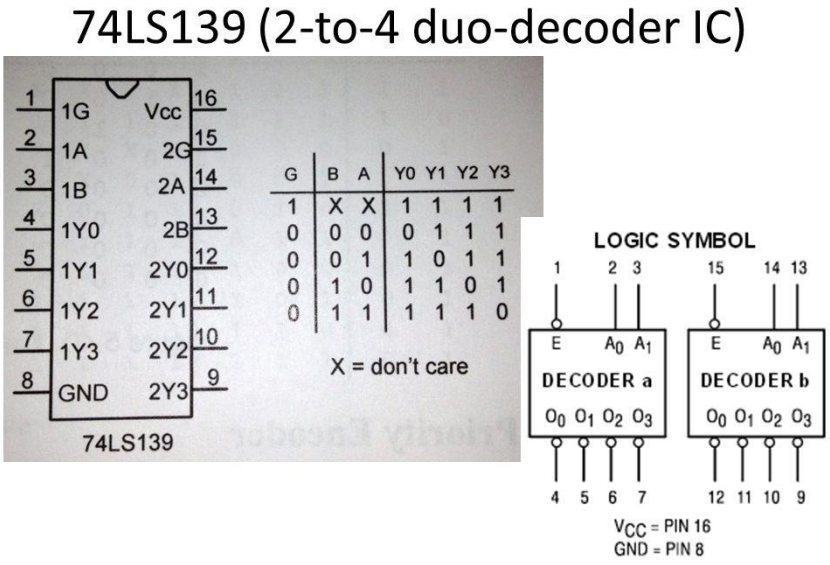

Figure 3-2 - Decoder Datasheet

3.1.1.1 Recommended Working Conditions

			MIN	MAX	UNIT
V_{CC}	Supply voltage	Operating	1.65	5.5	V
		Data retention only	1.5		
V_{IH}	High-level input voltage	V_{CC} = 1.65 V to 1.95 V	0.65 × V_{CC}		V
		V_{CC} = 2.3 V to 2.7 V	1.7		
		V_{CC} = 3 V to 3.6 V	2		
		V_{CC} = 4.5 V to 5.5 V	0.7 × V_{CC}		
V_{IL}	Low-level input voltage	V_{CC} = 1.65 V to 1.95 V		0.35 × V_{CC}	V
		V_{CC} = 2.3 V to 2.7 V		0.7	
		V_{CC} = 3 V to 3.6 V		0.8	
		V_{CC} = 4.5 V to 5.5 V		0.3 × V_{CC}	
V_I	Input voltage		0	5.5	V
V_O	Output voltage		0	V_{CC}	V
I_{OH}	High-level output current	V_{CC} = 1.65 V		–4	mA
		V_{CC} = 2.3 V		–8	
		V_{CC} = 3 V		–16	
				–24	
		V_{CC} = 4.5 V		–32	
I_{OL}	Low-level output current	V_{CC} = 1.65 V		4	mA
		V_{CC} = 2.3 V		8	
		V_{CC} = 3 V		16	
				24	
		V_{CC} = 4.5 V		32	
$\Delta t/\Delta v$	Input transition rise or fall rate	V_{CC} = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V		20	ns/V
		V_{CC} = 3.3 V ± 0.3 V		15	
		V_{CC} = 5 V ± 0.5 V		10	
T_A	Operating free-air temperature		–40	85	°C

Table 3-1 - 74139 Working Conditions

3.1.2 Three State Buffers 74**125

74HCT125 Quad Tri-State Buffer

LOGIC SYMBOL

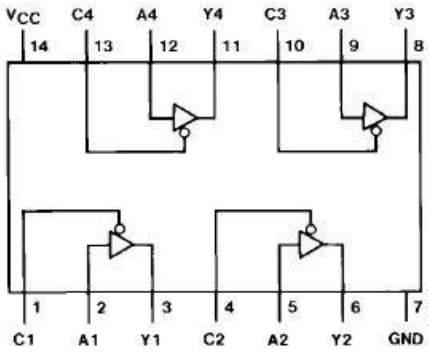

Figure 3-3 - 74125 Datasheet

3.1.2.1 Recommended Working Conditions

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		2	5	6	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5			V
		V_{CC} = 4.5 V	3.15			
		V_{CC} = 6 V	4.2			
V_{IL}	Low-level input voltage	V_{CC} = 2 V			0.5	V
		V_{CC} = 4.5 V			1.35	
		V_{CC} = 6 V			1.8	
V_I	Input voltage		0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	V
$\Delta t/\Delta v$	Input transition rise and fall time	V_{CC} = 2 V			1000	ns
		V_{CC} = 4.5 V			500	
		V_{CC} = 6 V			400	
T_A	Operating free-air temperature	SN54HC125	–55		125	°C
		SN74HC125	–40		85	

Table 3-2 - 74125 Working Conditions

3.1.3 Regulator 7805

From the above Conditions we need to regulate and smooth the volt from the direct power Supply, 7805 is used to convert from (regulate) the 9v to 5v input for the circuit. To meet the above conditions and to make sure that the ICs are working probably.

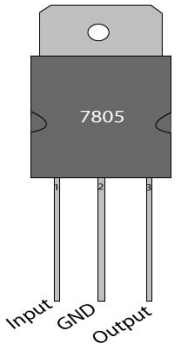

Figure 3-4 - Regulator 7805

3.1.3.1 Recommended working Conditions

			MIN	MAX	UNIT
V_I	Input voltage	µA7805	7	25	V
		µA7808	10.5	25	
		µA7810	12.5	28	
		µA7812	14.5	30	
		µA7815	17.5	30	
		µA7824	27	38	
I_O	Output current			1.5	A
T_J	Operating virtual junction temperature		0	125	°C

Table 3-3 - 78xx Working Conditions

3.1.4 LEDs and Resistors

To show the system outputs we used LEDs (light-emitting diode) for each bit of a register as each register is being represented by a tri state buffer IC.

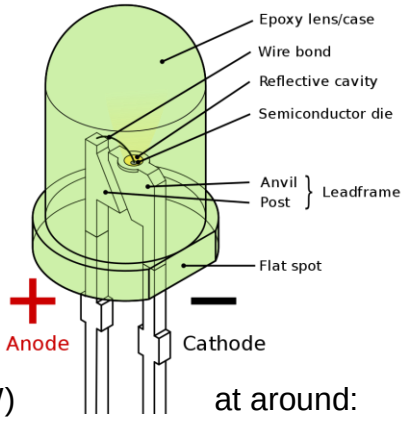

Figure 3-5 - LED

Many circuits operate LEDs at less than the recommended maximum current, to save power, to permit the use of a standard resistor value, or to reduce brightness. Typically, the forward voltage of an LED is between 1.8 and 3.3 volts. It varies by the color of the LED.

20 mA LEDs (ranging from approximately 40 mW to 90 mW) at around:

- 1.9 to 2.1 V for red, orange, yellow, and traditional green
- 3.0 to 3.4 V for pure green and blue
- 2.9 to 4.2 V for violet, pink, purple and white

Resistors are used to operate the Output LEDs under the above conditions.

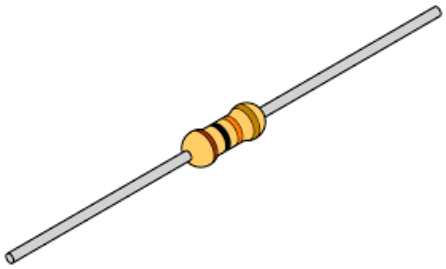

Figure 3-6 - Resistor

References and Appendices

Datasheets

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