Panel 1

Prior to Le03

Transistors:

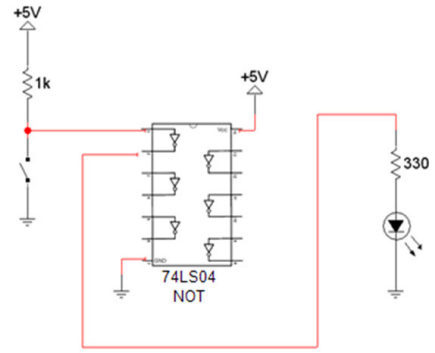
Why do we need 'em and how do we use 'em.

ME430 Mechatronics

1

Panel 2

Connect the LED via a NOT gate



2

Panel 3

To see how much current we've got we need datasheets!

1. Where do to find them
   -
   -
   -
   -
2. How do we read them
   -
   -
   -
   -

3

Panel 4

http://www.digikey.com/

4

Panel 5

http://www.jameco.com

5

Panel 6

http://www.datasheetcatalog.com/

6

Panel 7

http://www.google.com/

7

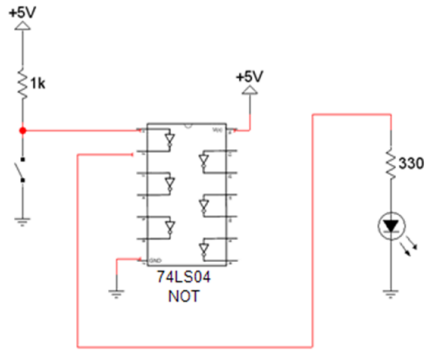
Panel 8

http://www.rose-hulman.edu/ME430

8

Panel 9

Hex Inverter sourcing the current



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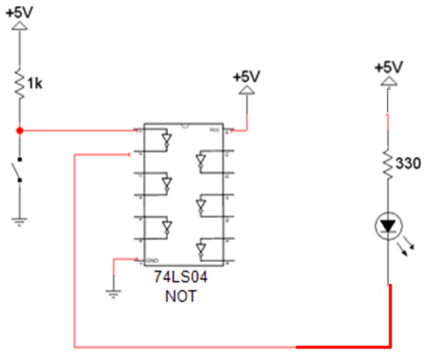
Panel 10

Hex Inverter sinking current



10

Panel 11

For you to fill in:

How much current does our LED draw? _____

How much current does the 74LS04 source? _____

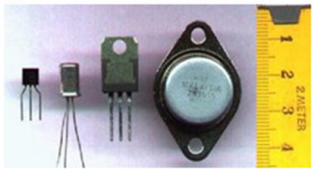
How much current does the 74LS04 sink? _____

What is the difference between sinking and sourcing current?

11

Panel 12

Transistor:
While not a mechanical switch, a transistor can be thought of as an electrically controlled switch.



12

Panel 13

Types of Transistors:

Bipolar Junction Transistors - BJT

Metal Oxide Semiconductor Feild Effect Transistors - MOSFET

Other types of transistors

13

Panel 14

The first transistor invented at Bell Labs in 1947.

The transistor was used to amplify electrical currents. Before it was developed, electron tubes (also called vacuum tubes) were common. But they were too large and delicate for many uses.

14

Panel 15

Just how many transistors are there in the world?

When people talk about big numbers they sometimes talk about ants.

Biologist Edmund Wilson has estimated that there are about 100 quadrillion ants on Earth.

In a single year there are about 100 times as many transistors produced — and the trend is accelerating.

15

Panel 16

Things we'll build in lab:

#1. Functional circuit with only LED

#2. Potentially functional circuit with 7404 powering a motor (pin 4) and LED
(If it doesn't turn at all try to start it by hand. It may work fine or may not work at all!)

#3. Potentially functional circuit with 7404 ***sinking*** current to the motor. (Note: To make the 7404 sink motor current connect one wire of the motor to 5 volts and the other wire to the 7404 pin 4. Now current goes from the supply into the chip. When is the motor on?)

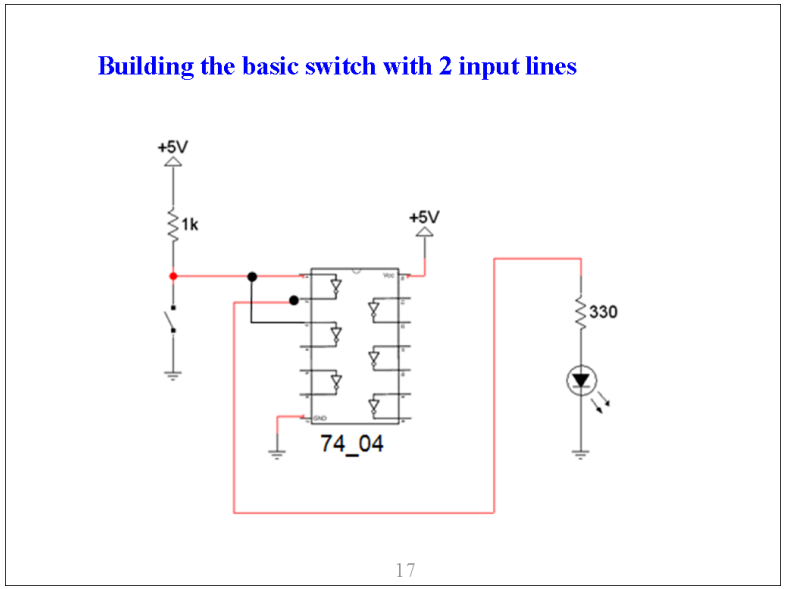
#4. Functional circuit using a NPN transistor (use pin 4, keep the LED circuit)

#5. Functional circuit using an N-channel MOSFET

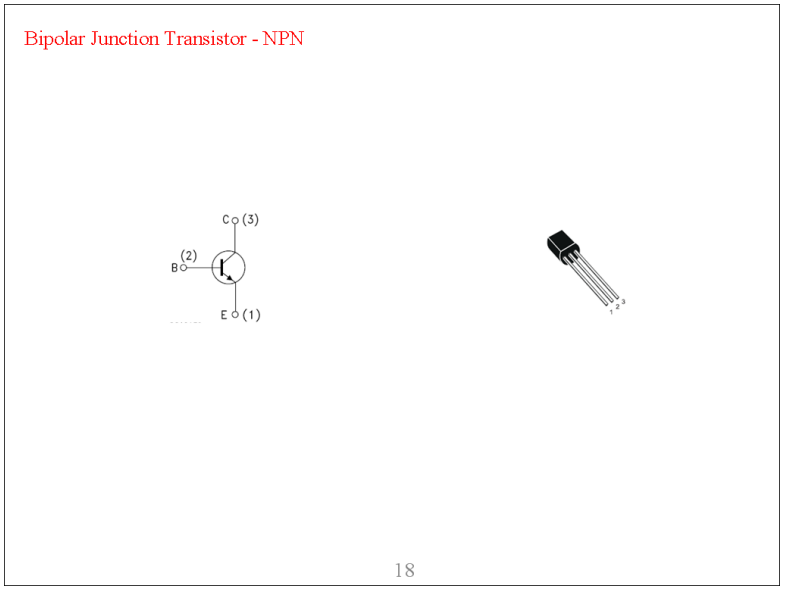
#6. Functional circuit using a Darlington

16

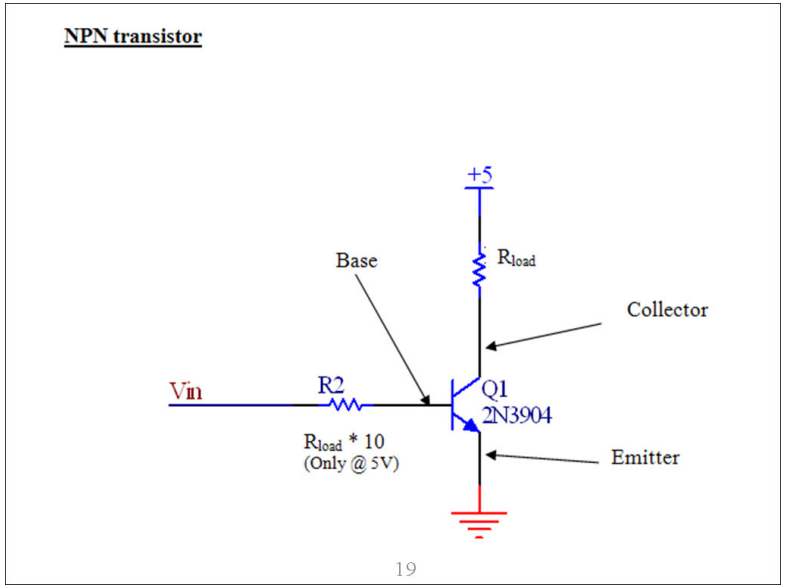
Panel 17



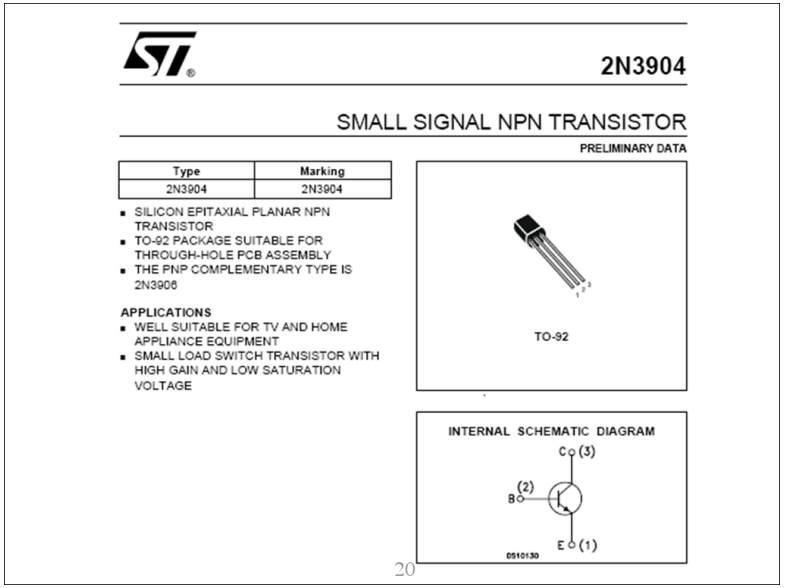
Panel 18



Panel 19



Panel 20



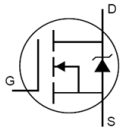
Panel 21

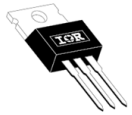
Draw the NPN transistor, label the legs, and write yourself a note about what that leg does.

21

Panel 22

MOSFET - N channel





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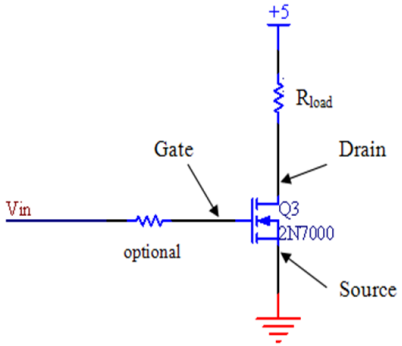
Panel 23

N-Channel



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Panel 24

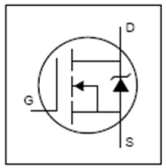
International
IOR Rectifier

PD - 9.1307B

IRLZ34N

HEXFET® Power MOSFET

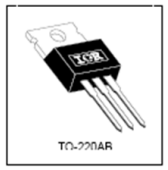
- Logic-Level Gate Drive
- Advanced Process Technology
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated



V_{DSS} = 55V

$R_{DS(on)}$ = 0.035Ω

I_D = 30A



Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve the lowest possible on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient device for use in a wide variety of applications.

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.

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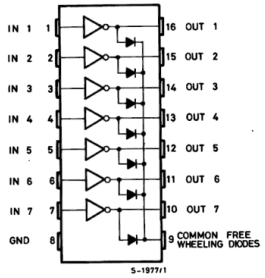
Panel 25

Draw the N Channel MOSFET, label the legs, and write a note about what that leg does.

25

Panel 26

Darlington



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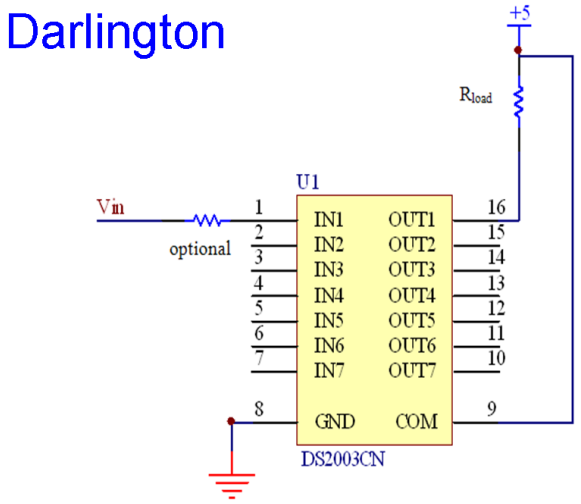
Panel 27



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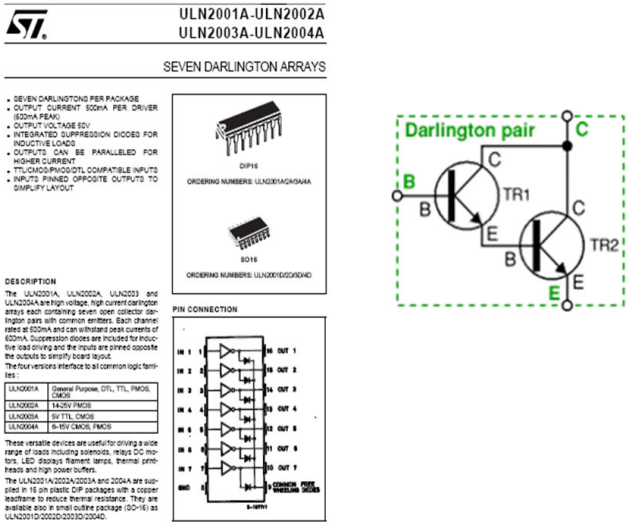
Panel 28



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Panel 29

Other topics relating to Transistors

H-Bridge circuits

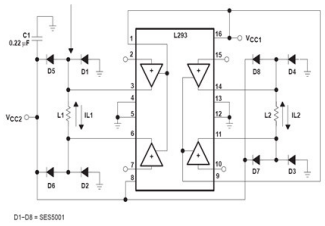
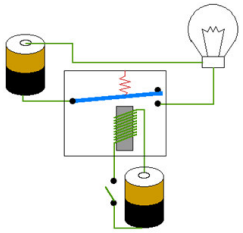


Figure 6. Bipolar Stepping-Motor Control

Relays



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