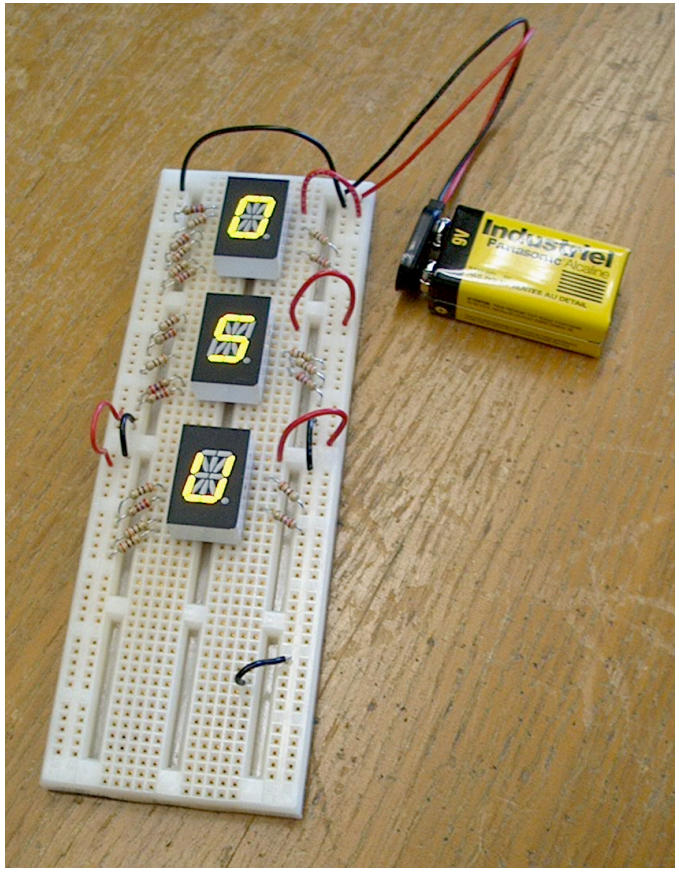
LED Display

Prof. Betty Lise Anderson

Here's what you're going to build



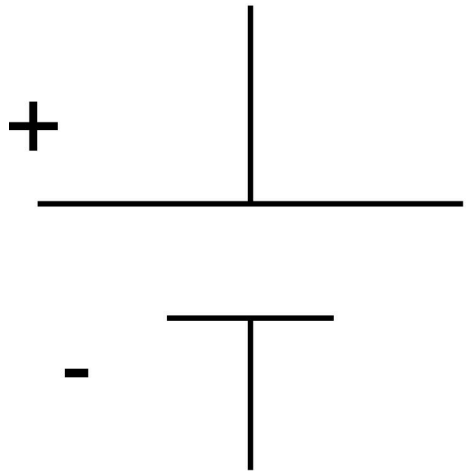
Need to learn some things

- How to read an electrical schematic
- What parts we're using
- How design the display
- How to build the display

Reading Schematics:

What's this?

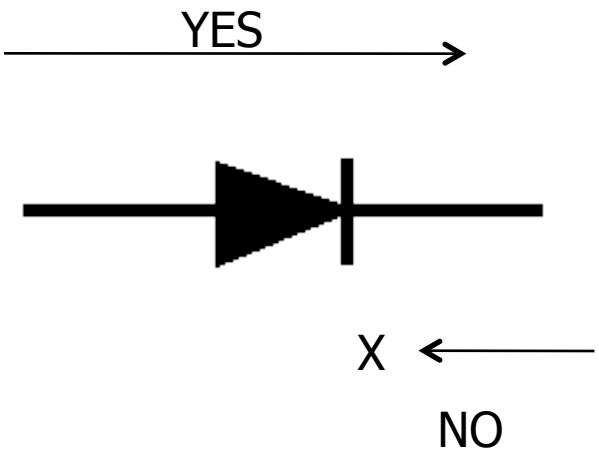
- Battery



How about this?

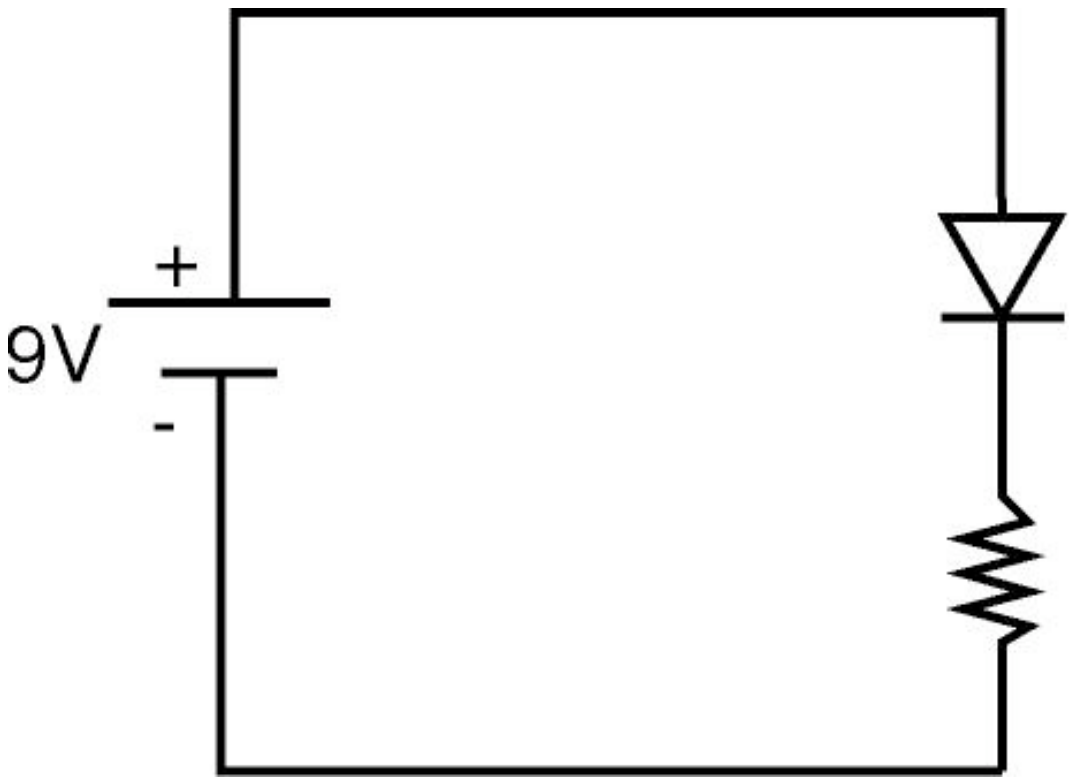
- Resistor

What's this?

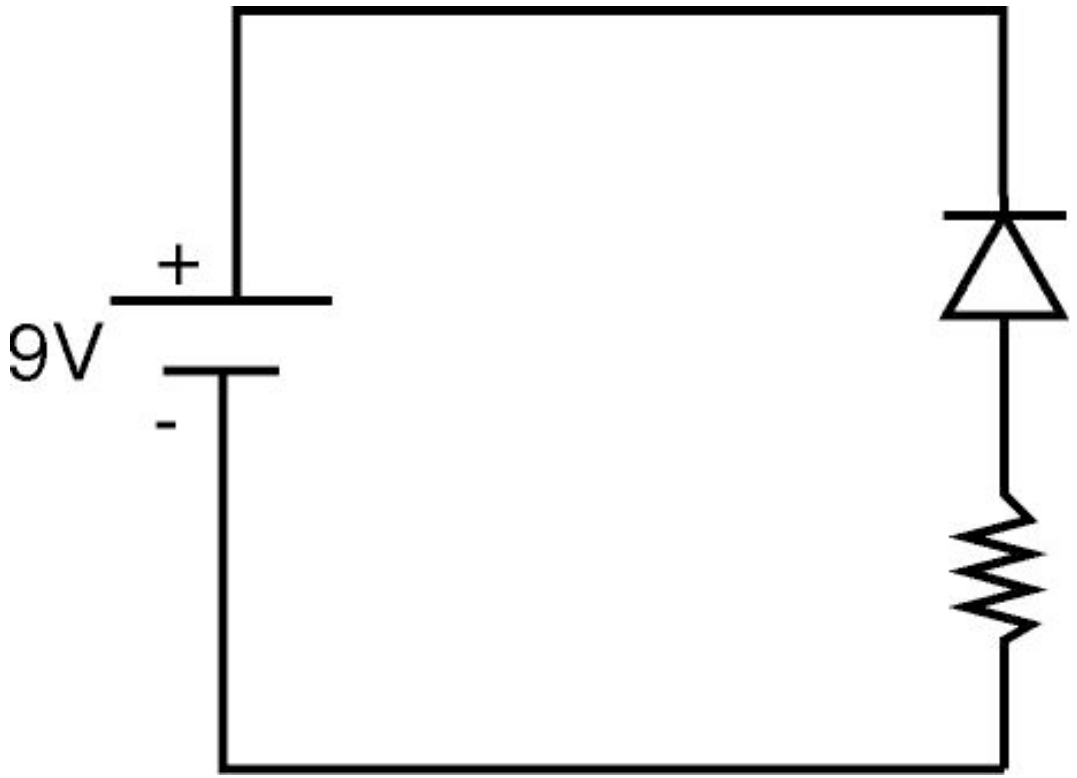


- Diode
  - Lets current flow one direction but not the other

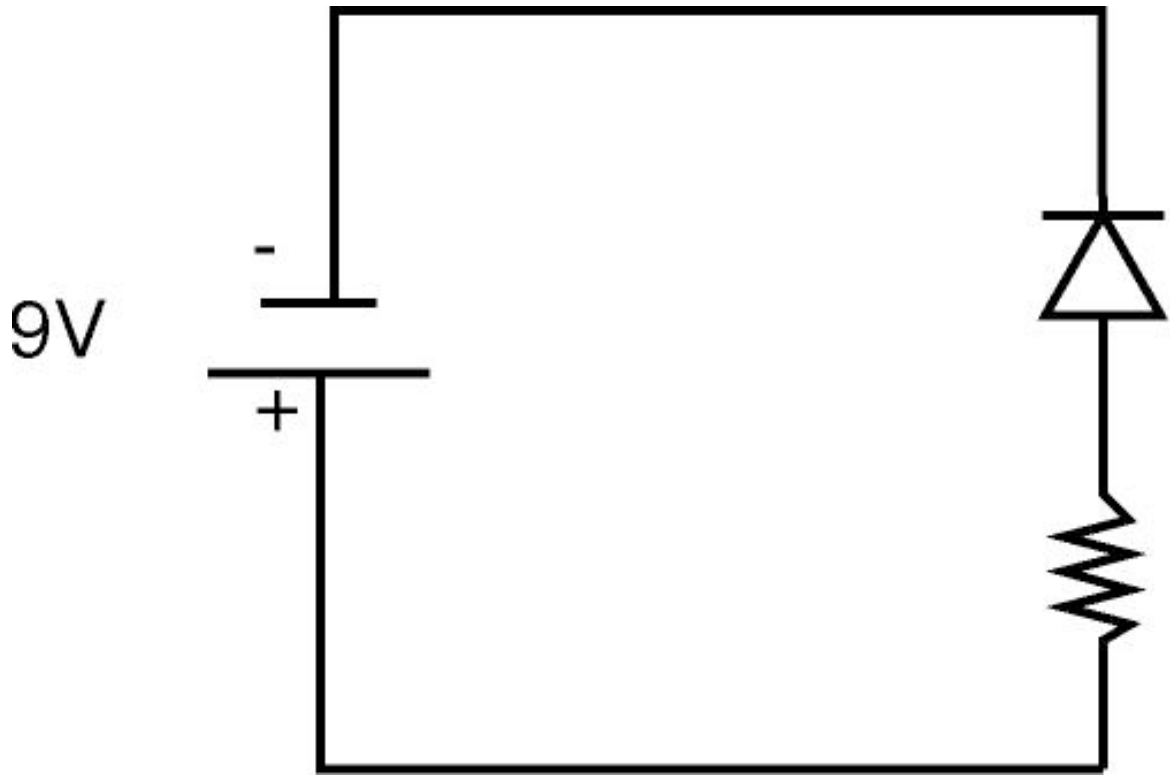
Will current flow?



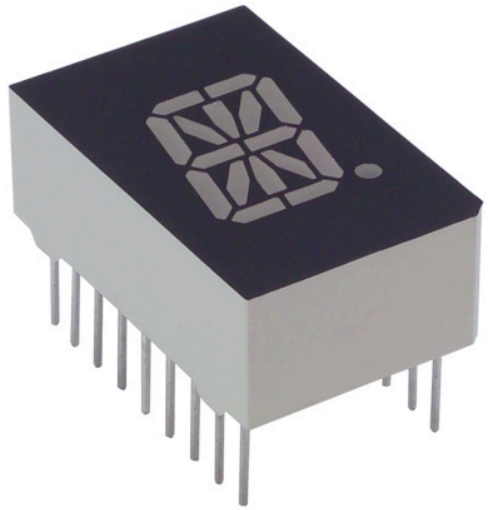
How about here?



And here?



Let's take a look at the components



- 16-segment alphanumeric display
  - Green, yellow, or red
- 18-pin package
- There is one LED inside for each segment

How to read the data sheet

LITEON LITE-ON ELECTRONICS, INC.

Property of Lite-On Only

FEATURES

∗0.5-INCH (12.7-mm) DIGIT HEIGHT.
∗CONTINUOUS UNIFORM SEGMENTS.
∗LOW POWER REQUIREMENT.
∗EXCELLENT CHARACTERS APPEARANCE.
∗HIGH BRIGHTNESS & HIGH CONTRAST.
∗WIDE VIEWING ANGLE.
∗SOLID STATE RELIABILITY.
∗CATEGORIZED FOR LUMINOUS INTENSITY.

DESCRIPTION

The LTP-587HR is a 0.5-inch (12.7-mm) height 16-segment single digit alphanumeric display. This device utilizes high efficiency red LED chips, which are made from GaAsP on GaP substrate, and has a red face and red segments.

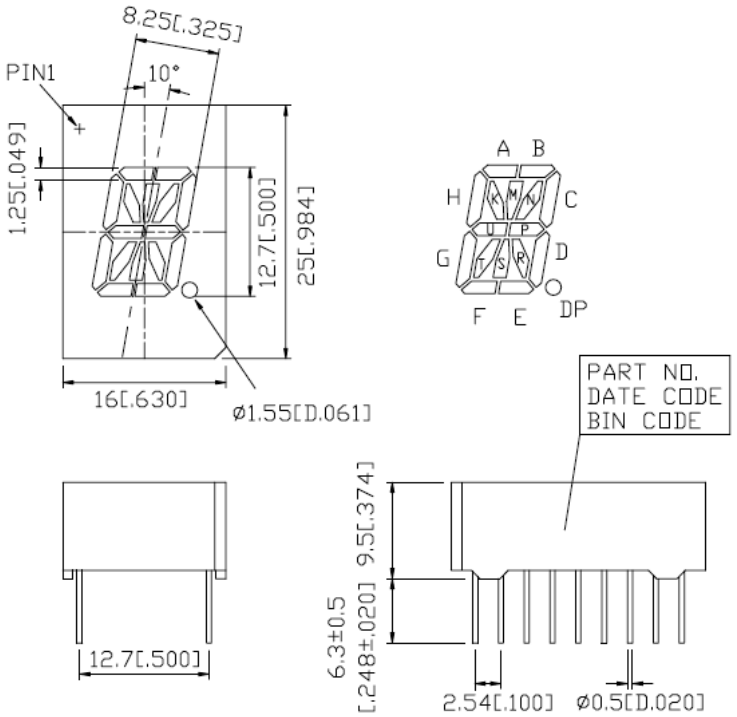
DEVICE

PART NO.	DESCRIPTION
HI.-EFF. RED	Common Anode,
LTP-587HR	Rt. Hand decimal

- This page is general propaganda

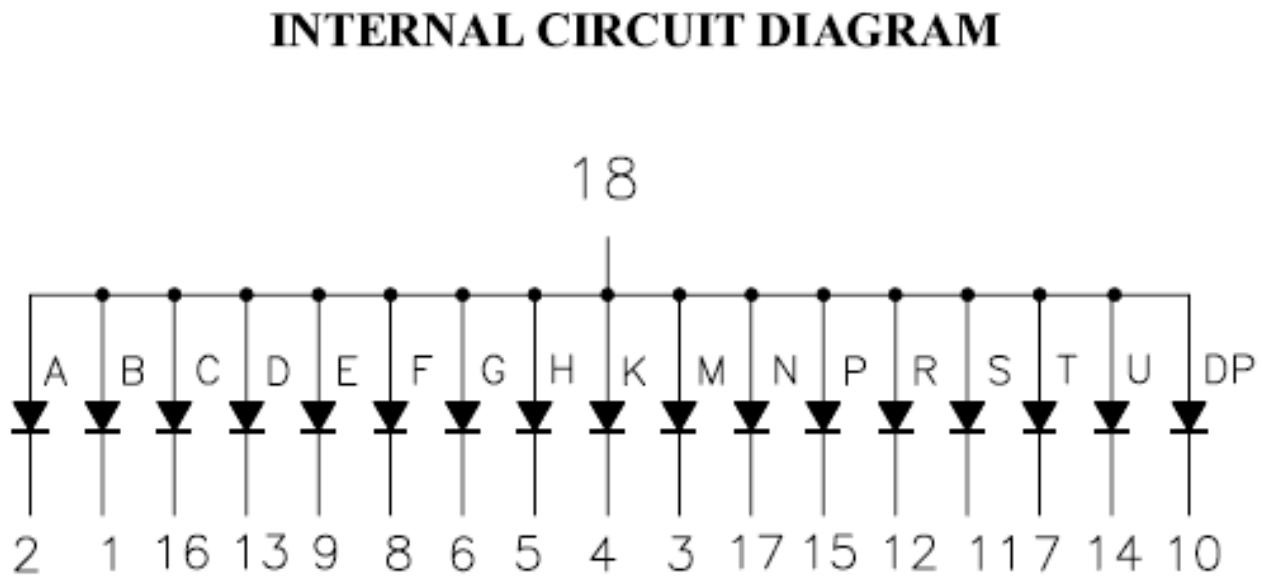
Next is dimensinos

PACKAGE DIMENSIONS



NOTES: All dimensions are in millimeters. Tolerances are ± 0.25-mm (0.01“) unless otherwise noted.

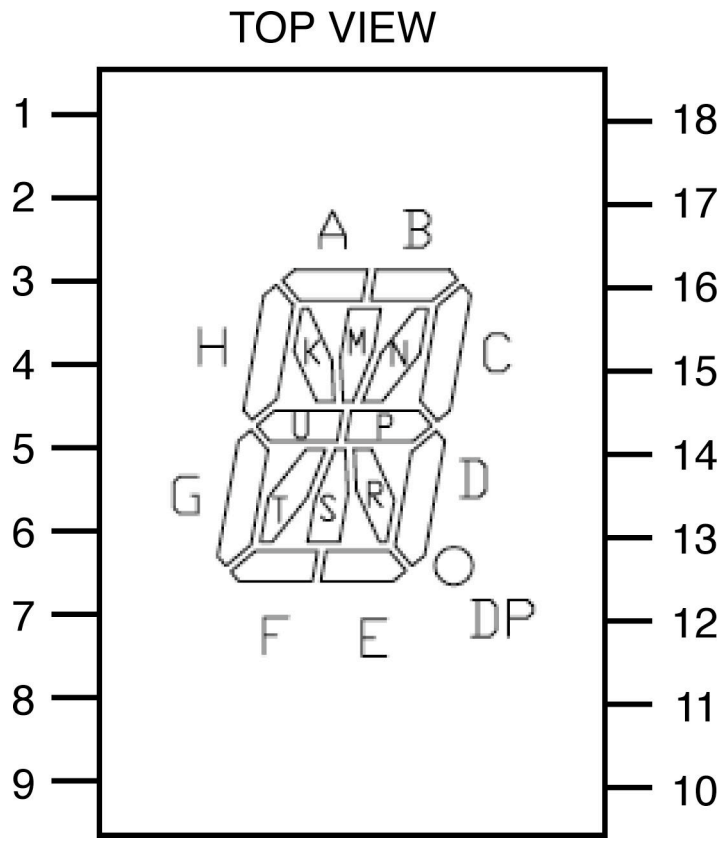
Ah hah! What's inside



This is called the pinout

PIN CONNECTION

No.	CONNECTION
1	CATHODE B
2	CATHODE A
3	CATHODE M
4	CATHODE K
5	CATHODE H
6	CATHODE G
7	CATHODE T
8	CATHODE F
9	CATHODE E
10	CATHODE D.P.
11	CATHODE S
12	CATHODE R
13	CATHODE D
14	CATHODE U
15	CATHODE P
16	CATHODE C
17	CATHODE N
18	COMMON ANODE



Absolute maximum ratings

ABSOLUTE MAXIMUM RATING AT Ta=25°C

PARAMETER	MAXIMUM RATING	UNIT
Power Dissipation Per Segment	75	mW
Peak Forward Current Per Segment (1/10 Duty Cycle, 0.1ms Pulse Width)	100	mA
Continuous Forward Current Per Segment Derating Linear From 25°C Per Segment	25 0.33	mA mA/°C
Reverse Voltage Per Segment	5	V
Operating Temperature Range	-35°C to +85°C	
Storage Temperature Range	-35°C to +85°C	
Solder Temperature 1/16 inch Below Seating Plane for 3 Seconds at 260°C		

Electro-optical characterisitics

ELECTRICAL / OPTICAL CHARACTERISTICS AT Ta=25°C

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Average Luminous Intensity	Iv	800	2200		µcd	I_F=10mA
Peak Emission Wavelength	λp		635		nm	I_F=20mA
Spectral Line Half-Width	Δλ		40		nm	I_F=20mA
Dominant Wavelength	λd		623		nm	I_F=20mA
Forward Voltage. Per Segment	V_F		2.0	2.6	V	I_F=20mA
Reverse Current, Per Segment	I_R			100	µA	V_R=5V
Luminous Intensity Matching Ratio	Iv-m			2:1		I_F=10mA

Additional information

TYPICAL ELECTRICAL / OPTICAL CHARACTERISTIC CURVES

(25°C Ambient Temperature Unless Otherwise Noted)

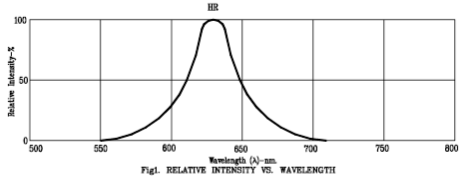


Fig1. RELATIVE INTENSITY VS. WAVELENGTH

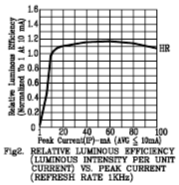


Fig2. RELATIVE LUMINOUS EFFICIENCY (LUMINOUS INTENSITY PER UNIT CURRENT) VS. PEAK CURRENT (REFRESH RATE 1KHz)

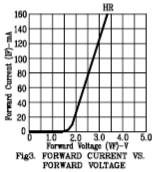


Fig3. FORWARD CURRENT VS. FORWARD VOLTAGE

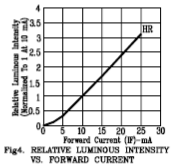


Fig4. RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

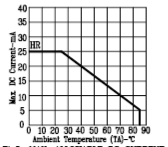


Fig5. MAX. ALLOWABLE DC CURRENT VS. AMBIENT TEMPERATURE

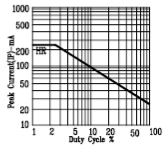
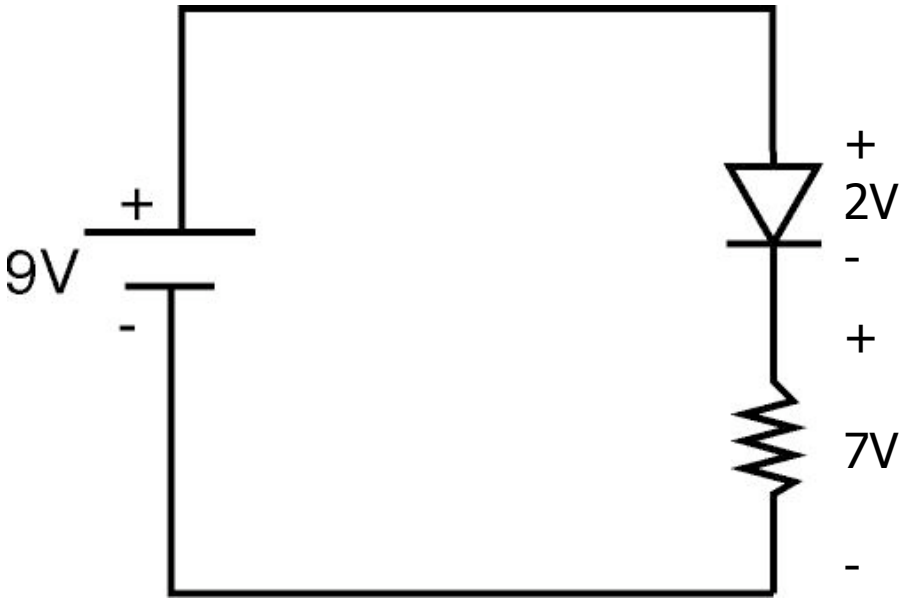


Fig6. MAX. PEAK CURRENT VS. DUTY CYCLE % (REFRESH RATE 1KHz)

NOTE: HR=HI.-EFF.RED

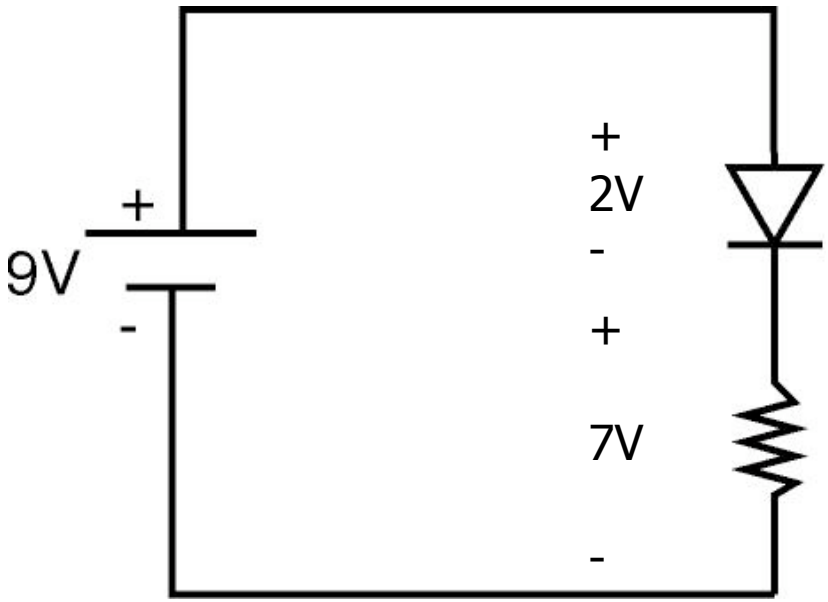
What value of resistor?

- What is voltage across the diode?
  - Hint: look at electro-optical characteristics
- How much is left to go across the resistor?



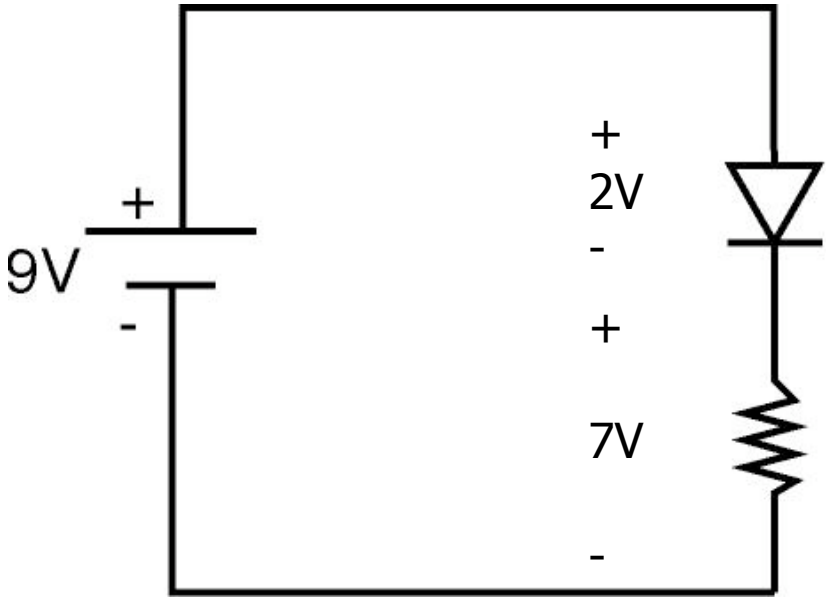
V=IR

- I= current
- R=resistance
- Don't exceed 25 mA through diode
  - see absolute maximum ratings)
- What are tradeoffs in choosing current?



So, what will you choose?

- R=V/I
- Example:
  - V=7V
  - Choose I=20 mA
    - 0.020 Amps
    - R=7/0.02=350 Ohms
  - We don't have that
  - But we have something close



So here's what you'll build

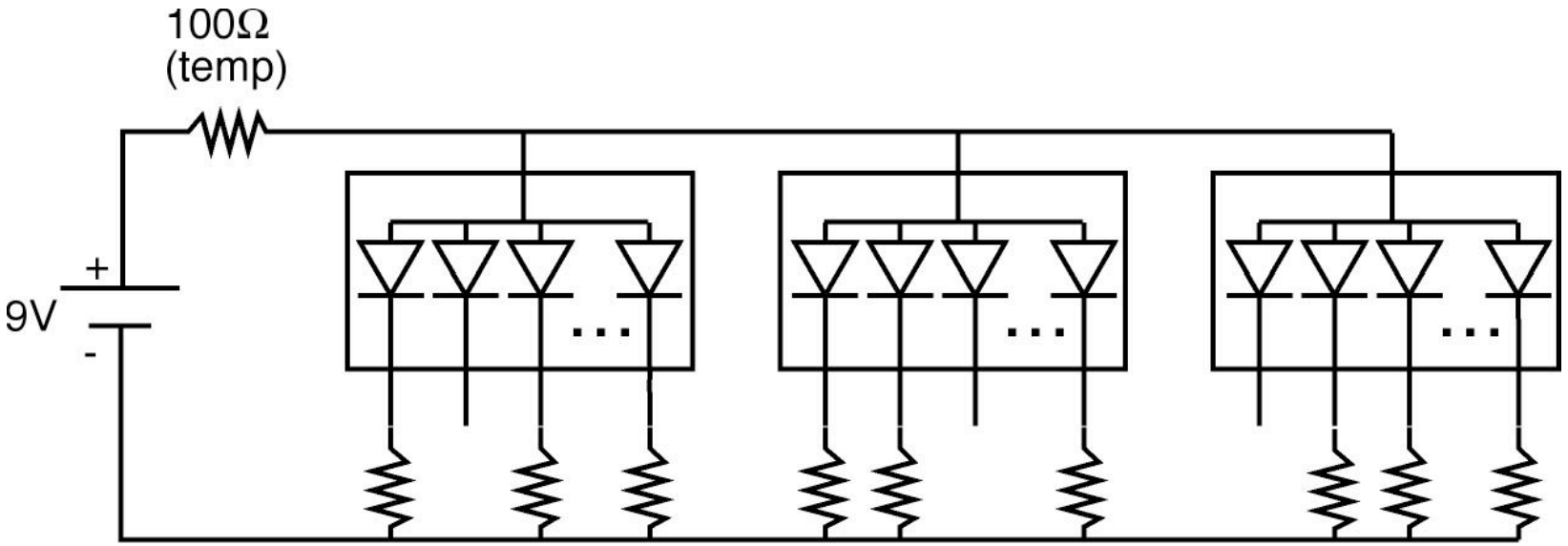
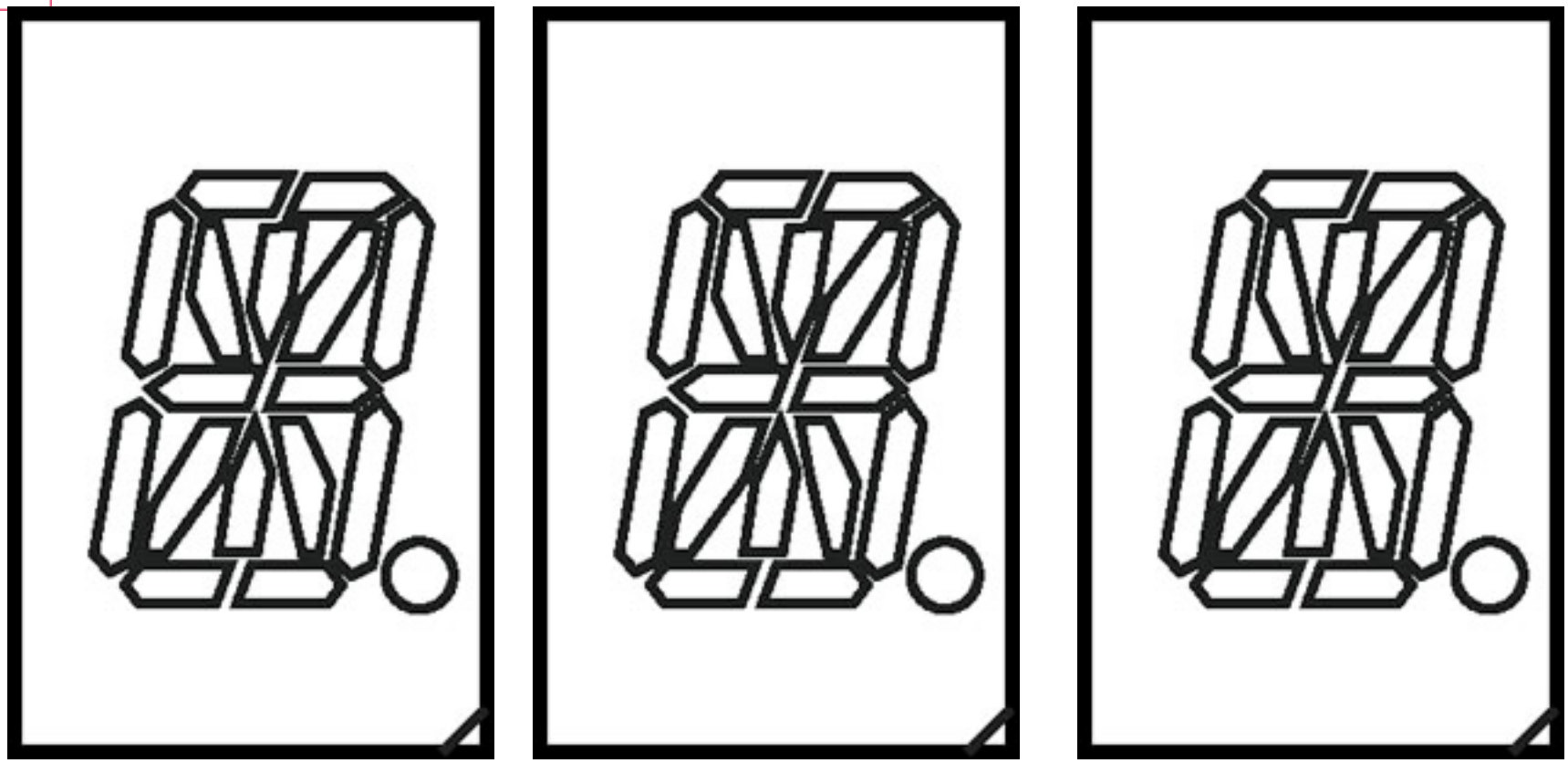
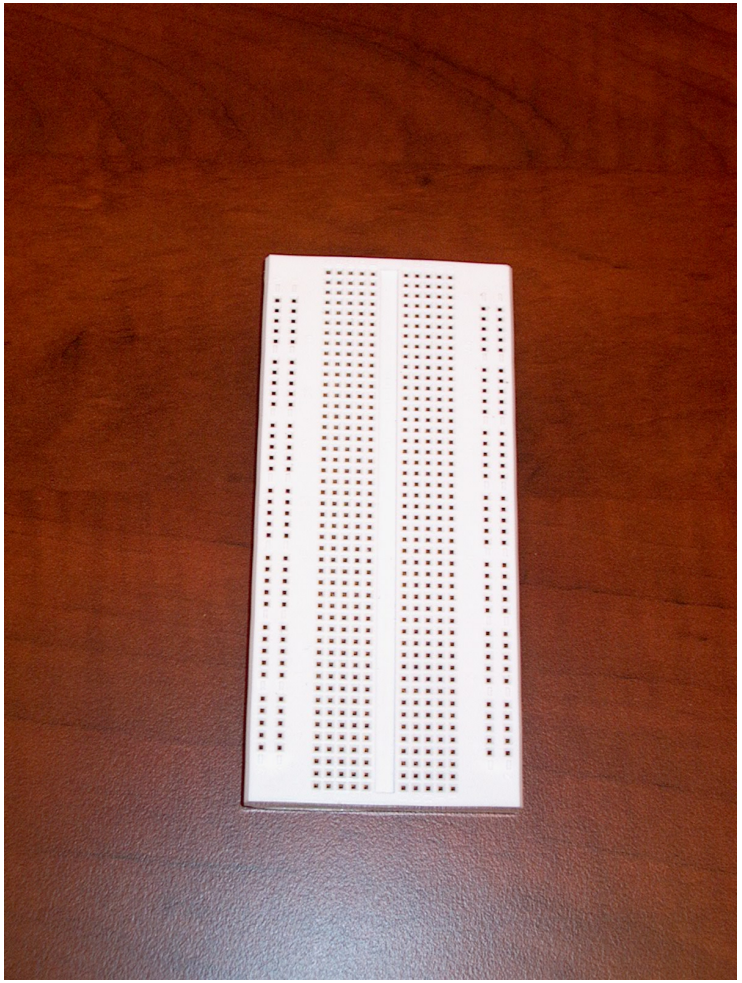


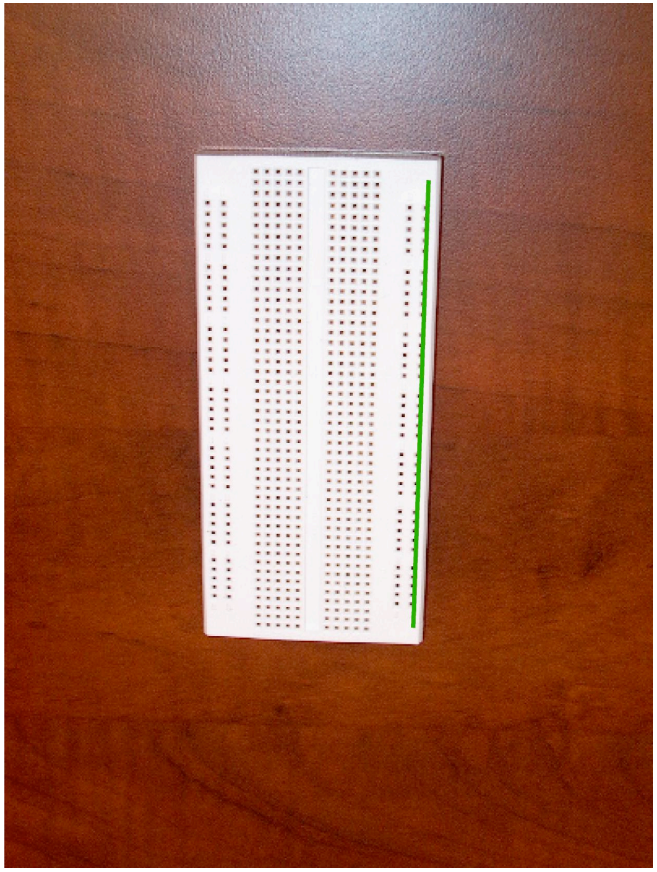
Figure out what to write



The breadboard

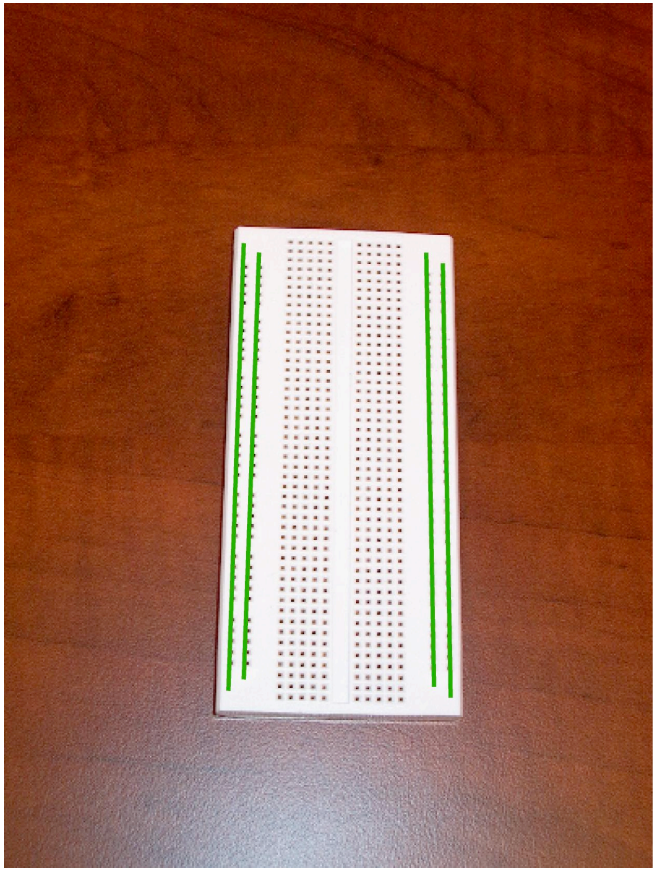


The buses

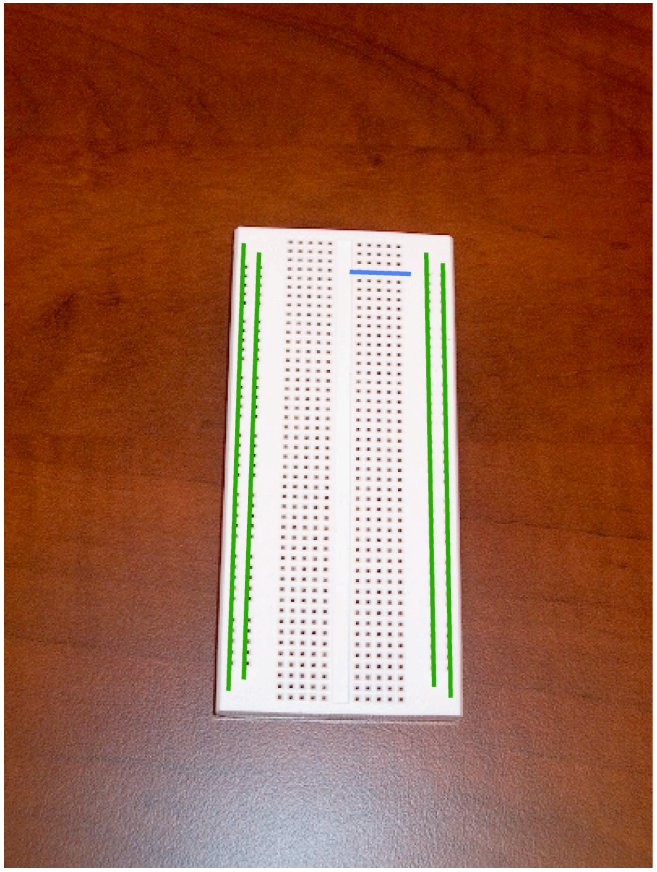


Every hole along this green line is electrically connected

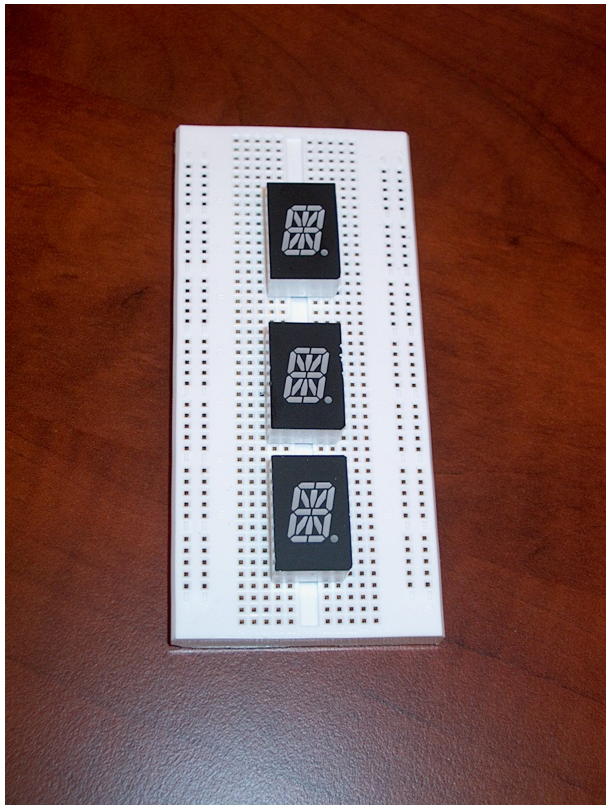
There are four buses you can use



All rows connected too



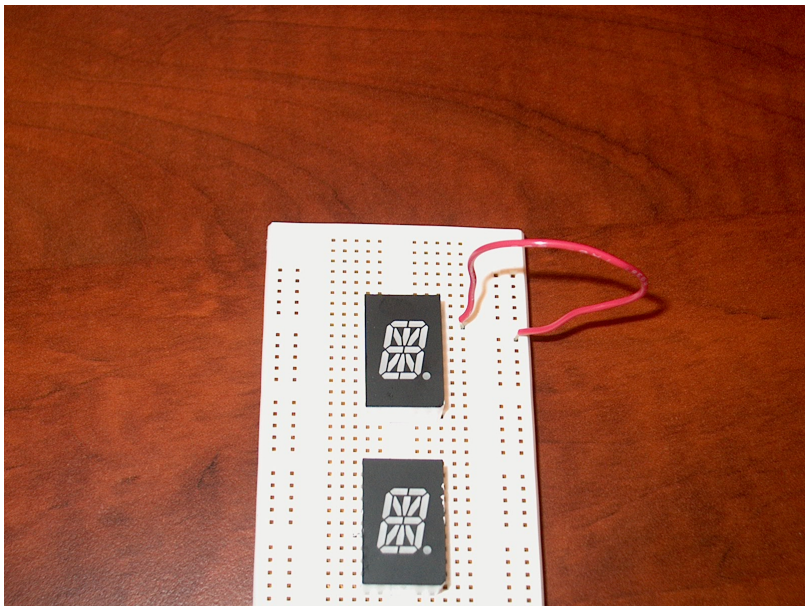
To connect to your devices



- Recommend putting displays across center channel

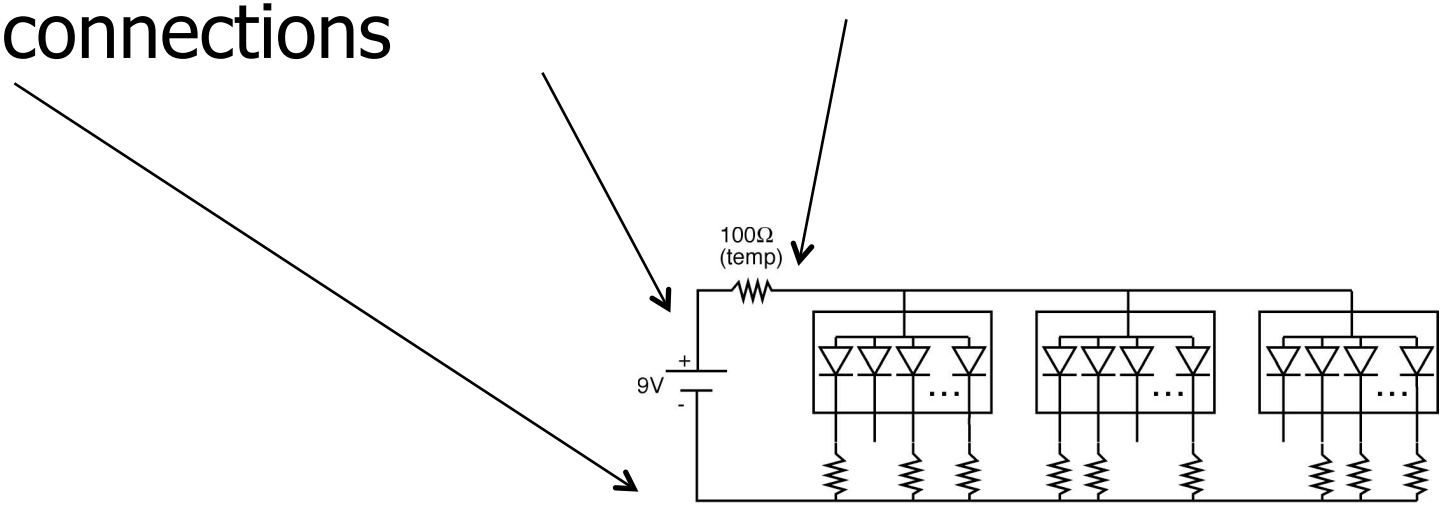
To make connections

- One end of wire is connected to the bus
  - And anything else connected there
- Other end is connected to one pin

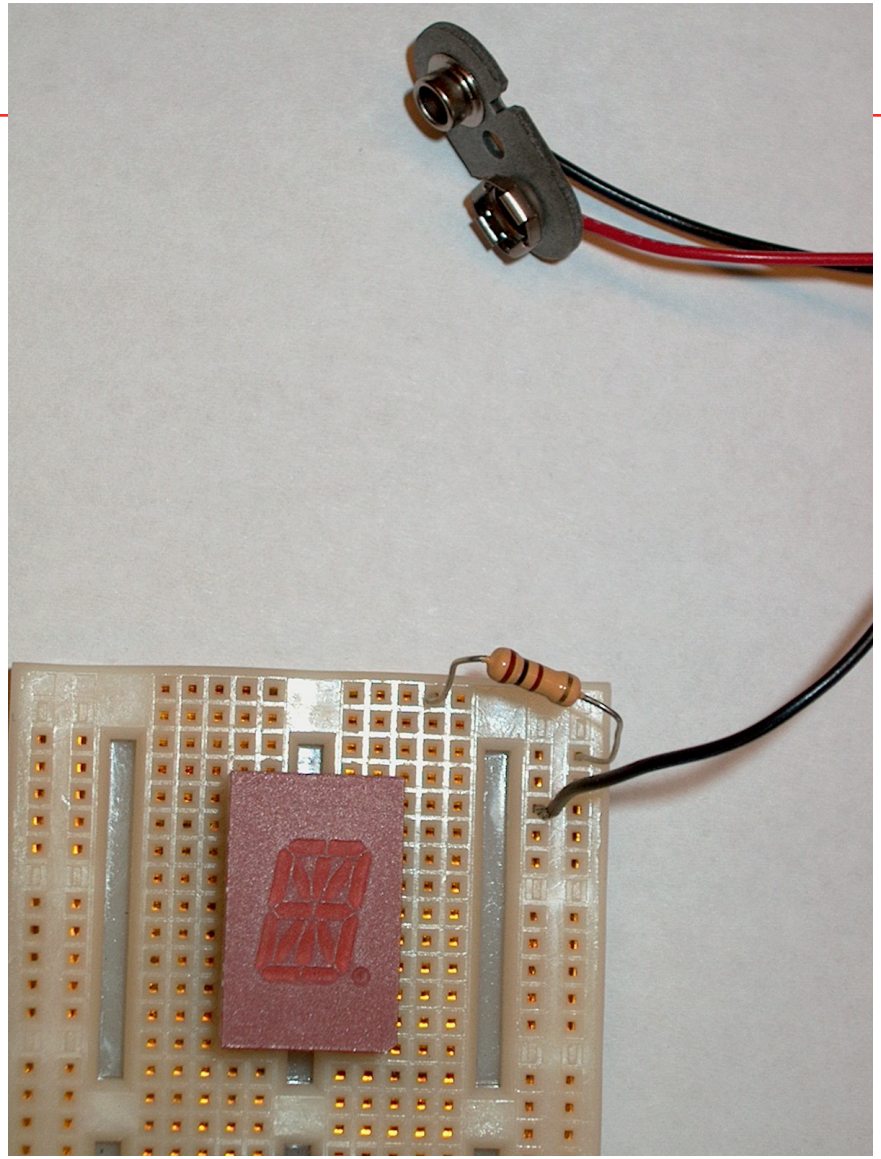


Now, look at circuit diagram

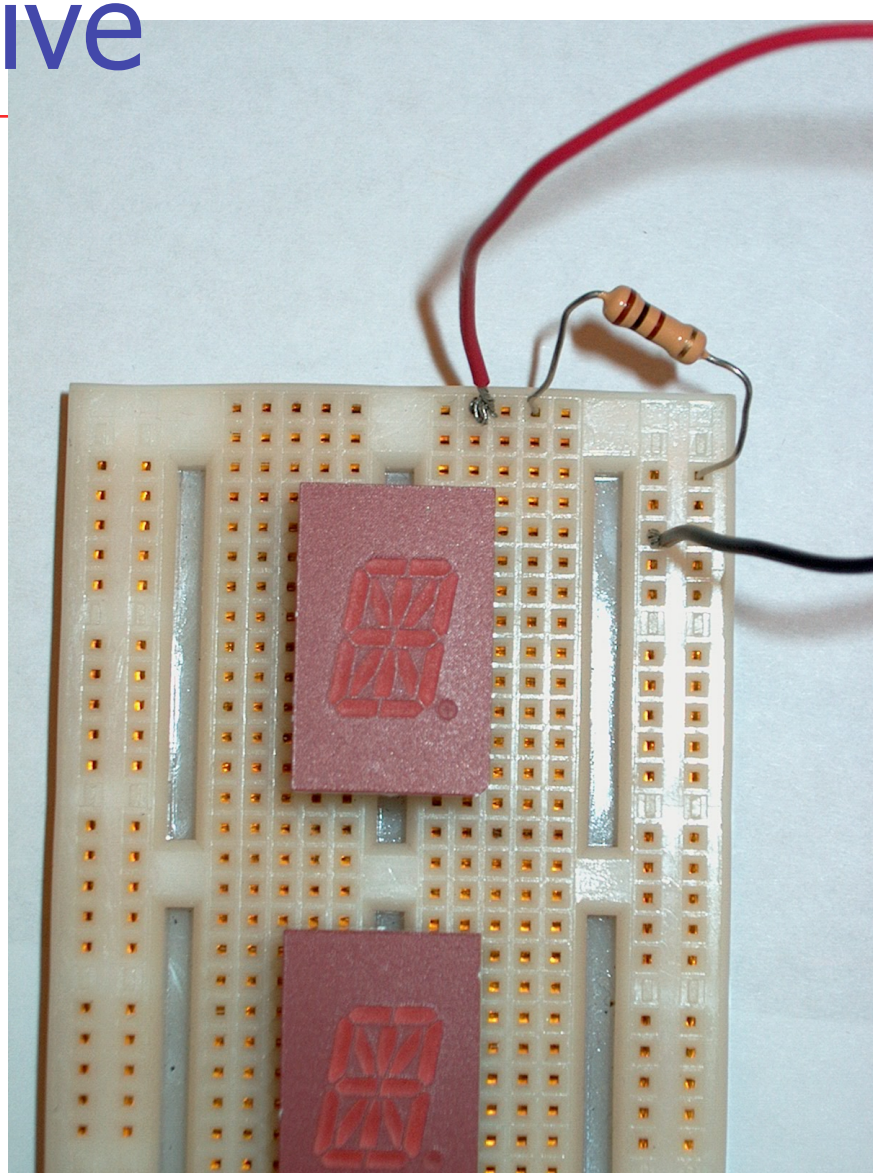
- Need to make these connections



Negative bus and safety resistor

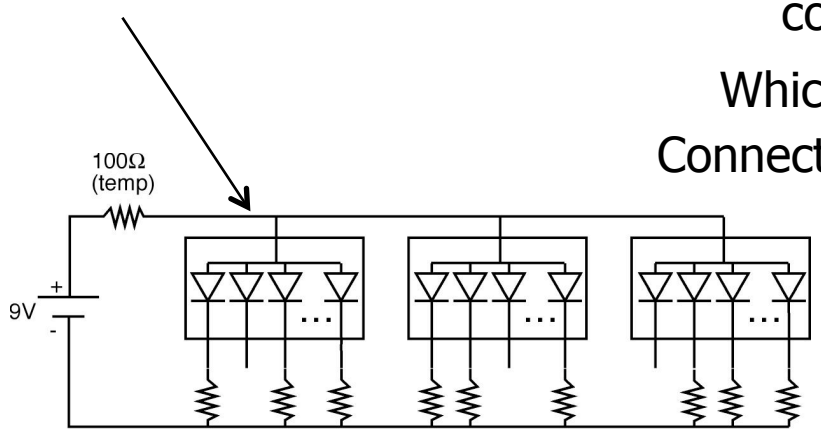


Connect positive



Now, look at circuit diagram

- Need to make this connections



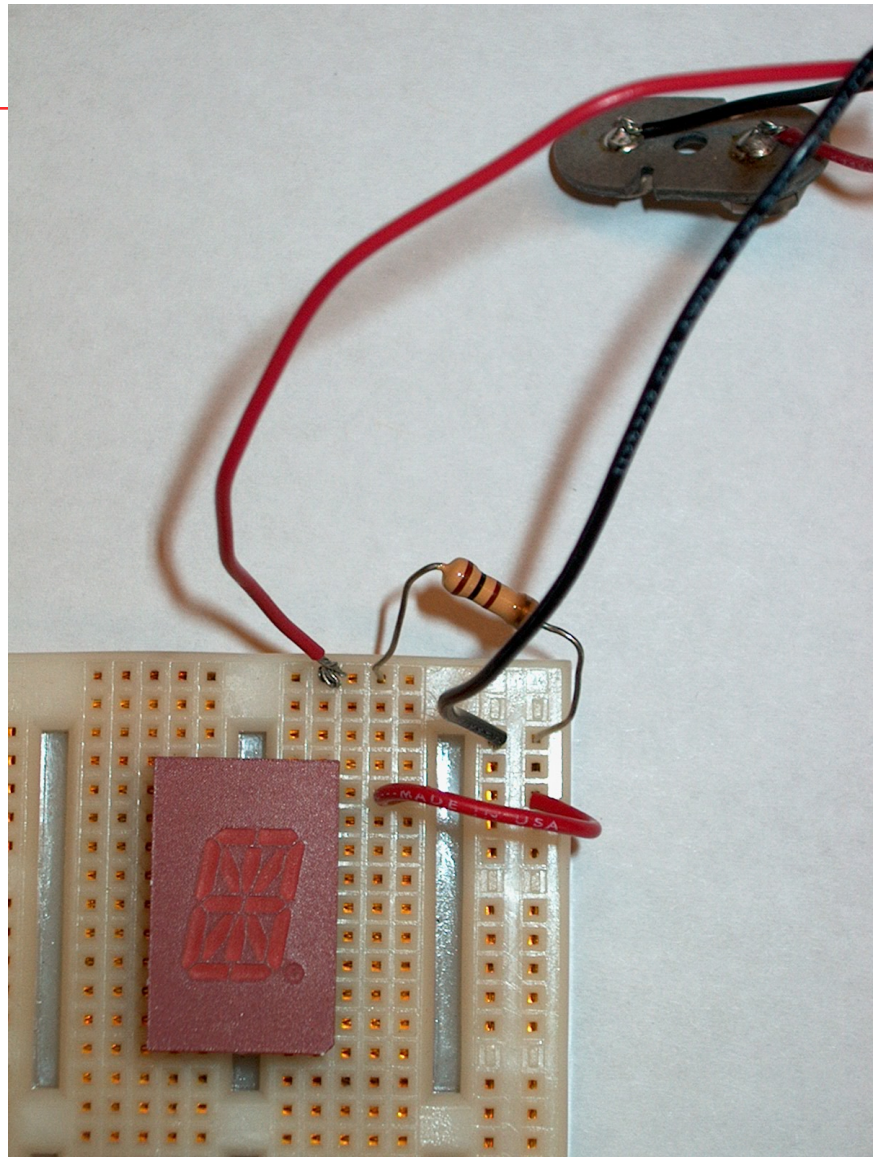
What pin is this on the display?

All anodes connected to a common point at this pin

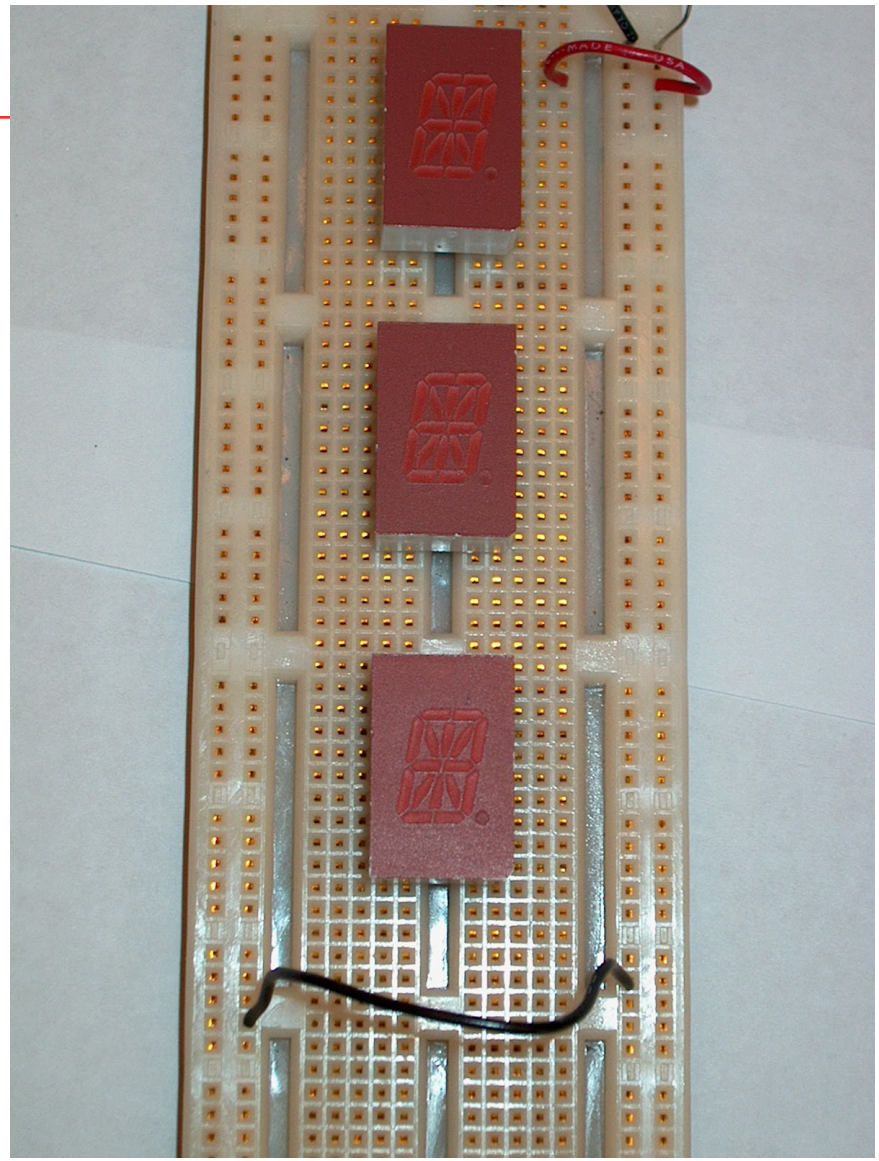
Which pin is the common anode?

Connect pin 18 to the positive bus

Connect common anode to positive bus

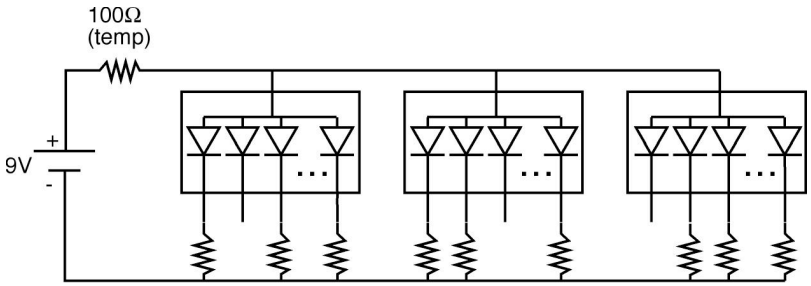


Another negative bus will come in handy

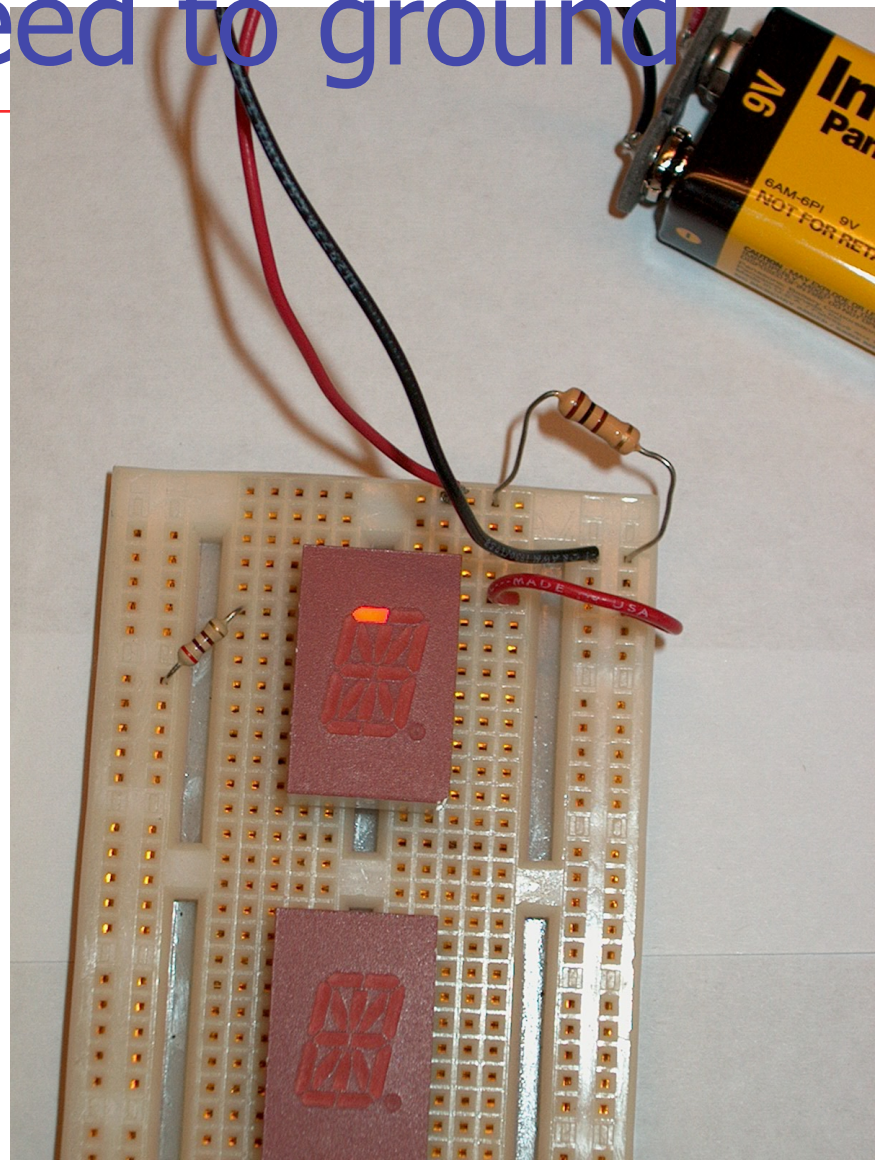


Next, connect cathodes

- One resistor for every segment you want to light?
- Where do you connect them?



Connect resistor for every cathode you need to ground



OK, once it's working

- Repeat for every other segment
- Once done, remove safety resistor