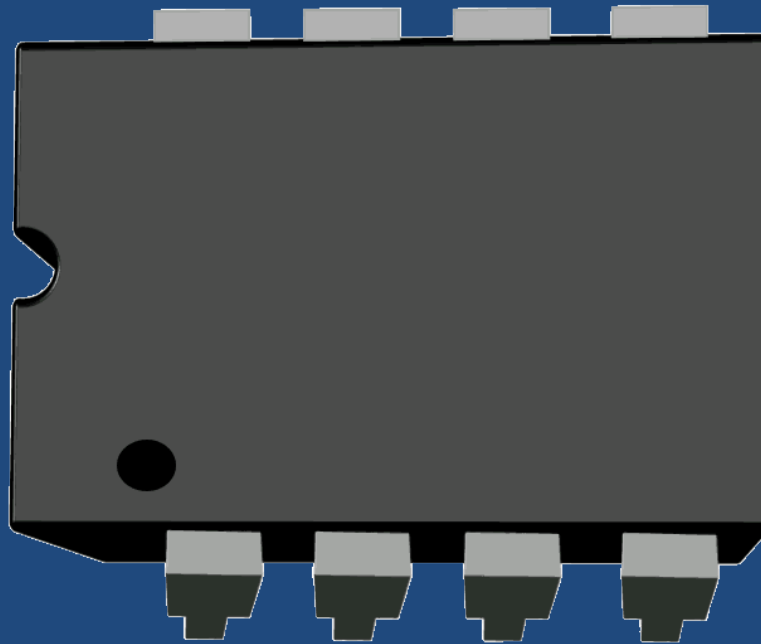


# IC Basics

## Integrated Circuit Basics



Eight-pin IC, we use the 741 & 555

Integrated circuits can be defined as:

Integrated circuits (ICs) are, much as their name would suggest, small circuits integrated into a plastic holder/"chip." Many ICs are really fairly simple -- often just consisting of multiple copies of a simple 2- or 3-element circuit, in a small, handy, package.

The information on these subfamilies is also found in lesson 3466-1 in Topic 11. Here are some TTL "subfamilies":

- 74LXX -- low-power TTL (1/10 the speed, 1/10 the power of "regular" TTL)
- 74HXX -- high-speed TTL (twice as fast, twice as much power)

- 74SXX -- Schottky TTL (for high-frequency uses)
- 74LSXX -- combination of low-power & Schottky, same speed as regular TTL, but at 1/5 the power consumption

# CMOS -- Complimentary Metal Oxide Silicon

- CMOS ICs use much less power than TTL, plus they are fairly forgiving of "slop" in input voltage -- they're happy with anything between 3 and 12 volts. (some, like 1381s, go lower)

- CMOS, though, is much more susceptible to damage from static electricity (Use a grounding strap to eliminate damage due to static electricity). This static is sometimes called ESD (Electro Static Discharge).

Get used to using “grounding straps” if you are working on computers or other static sensitive equipment.

- CMOS comes in two types, with corresponding numbering schemes: **"CD40XX" metal gate CMOS**, and **"74CXX" silicon gate CMOS** (note that this second subfamily borrows its numbering scheme from TTL ICs).

- **Metal gate CMOS (CD40XX)** has a rated working voltage of 3 - 15 V but can be used down to 2V.
- **Silicon gate CMOS (74CXX)** logic has a working voltage range of 2 - 6V but can be used to less than 1V. For microwatt power applications you want to use the lowest possible voltage.



You will become familiar with the many gates in this lesson.

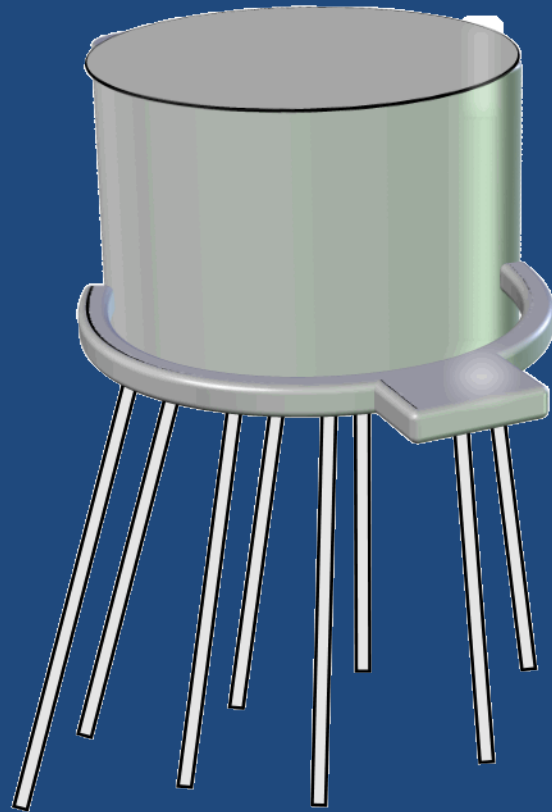
- You will become familiar with the AND Gate, OR Gate, NAND Gate, NOR Gate and the NOT Gate which is also known as an Inverter. You may also hear about Buffers in future lessons.

# Pinout Diagrams

- The following slides illustrate some of the commonly used ICs in Digital Electronics. The Pinout Diagrams illustrate the schematic symbol of the gate and what pins are used from the gates to the leads of the IC.

- The Pinout Diagram is used to identify the input and output leads of the ICs to aid in wiring the circuits on the breadboards while in class and for troubleshooting both while learning the operation and when in the work shop troubleshooting broken equipment.

# TO-5 Package



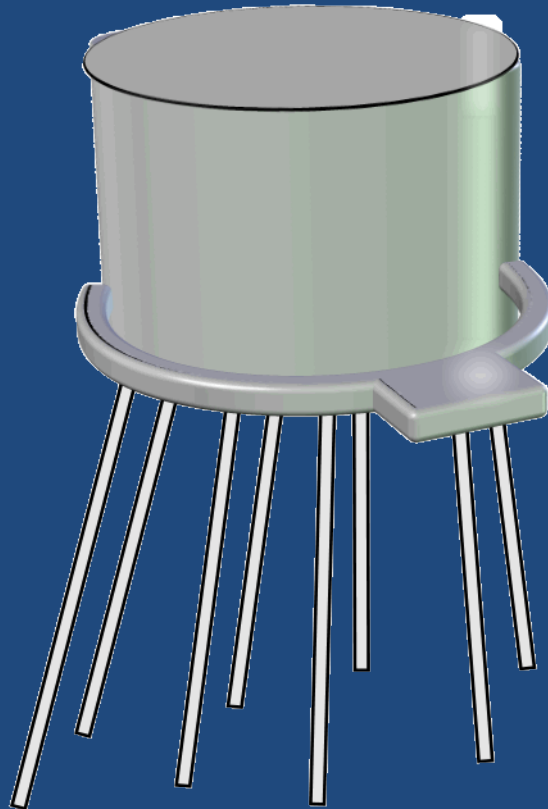
TO-5 Package

# TO-5 Package

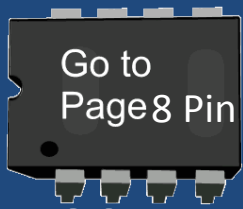
- The **TO-5** is a type of 'metal can' package (also known as 'metal header' package) for semiconductor devices. It is hermetically sealed to protect the device from environmental factors such as contaminants and moisture. The TO-5 is commonly used in housing transistors and integrated circuits with low lead counts such as operational amplifiers

- The TO-5 is made primarily of metal, with the microchip mounted on the die pad of its metal header and then sealed with a metal cap by high-current welding.
- Most TO-5 packages come with three terminals, since the TO-5 is commonly used in three-terminal devices such as transistors. However, TO-5 packages with more terminals than this are also quite common.

The tab indicates pin 1. The lead closest to the tab is pin 1.



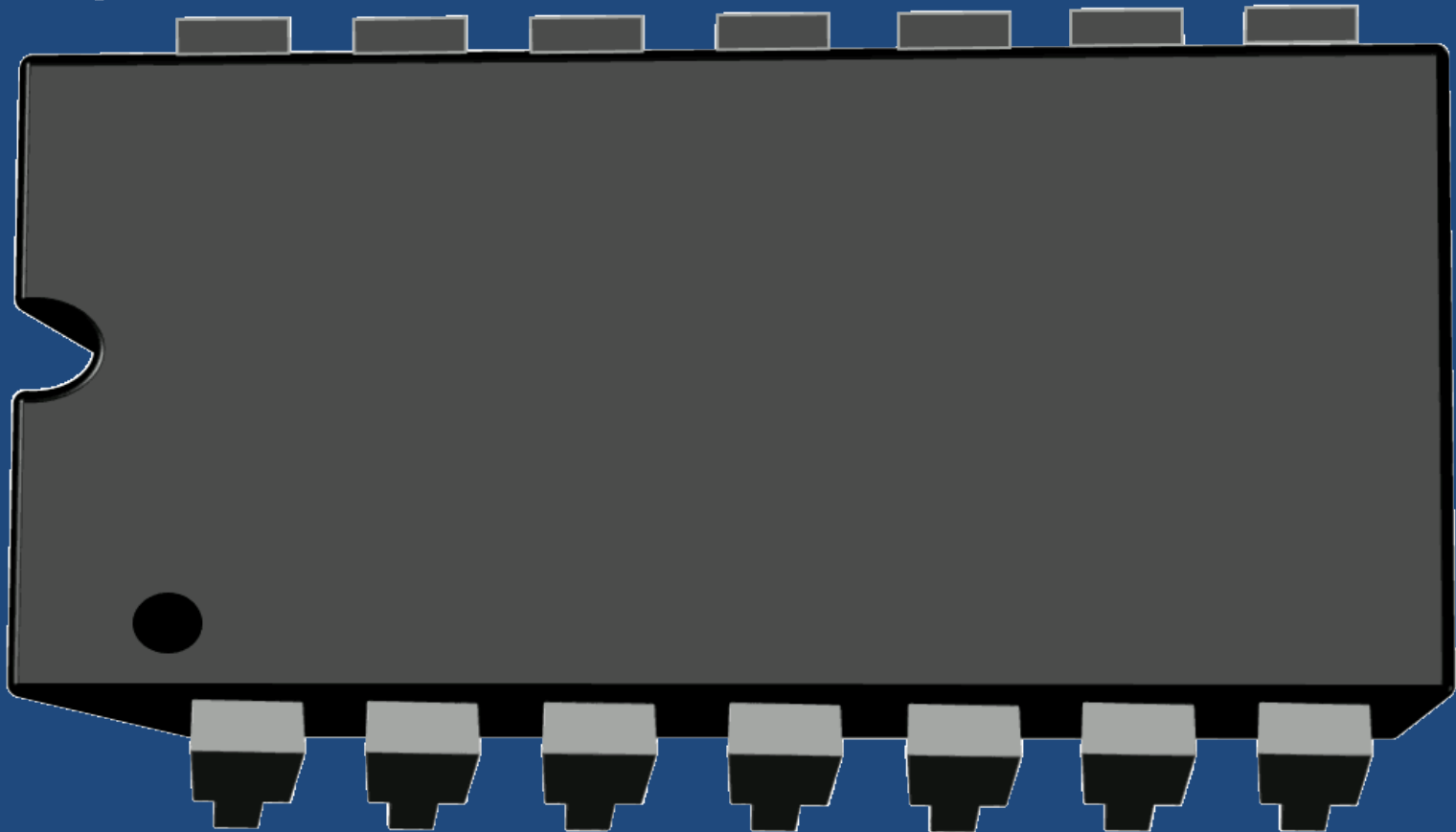
**TO-5 Package**



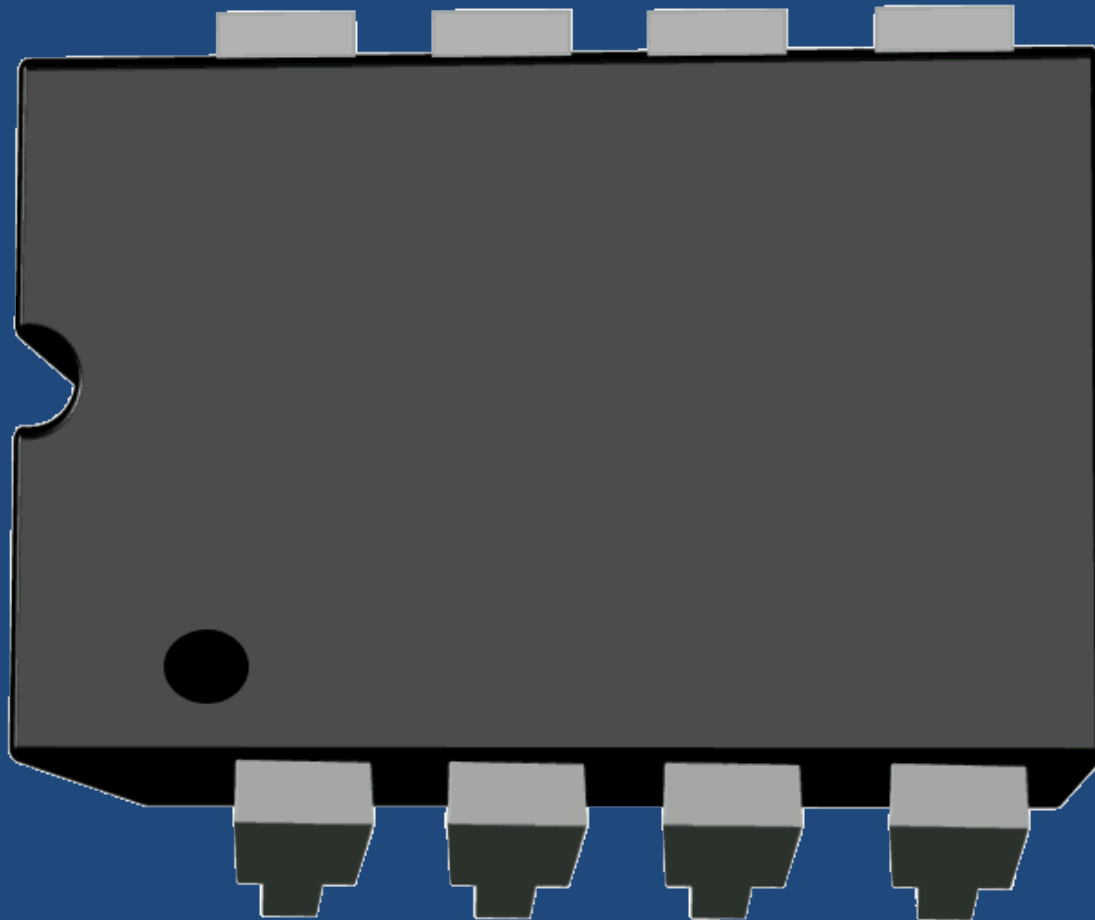
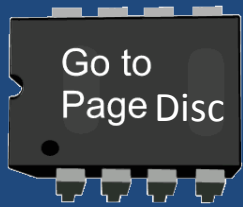
- You must learn to recognize which pin is Pin one on the ICs. The dot in the corner of the chip designates pin 1. This is true on the schematic symbol and on the actual IC. Count down, up, and across from pin 1.
  - Look at the next slide to see if you can recognize which pin is pin 1 and the other pin numbers.



Go to  
Page Disc

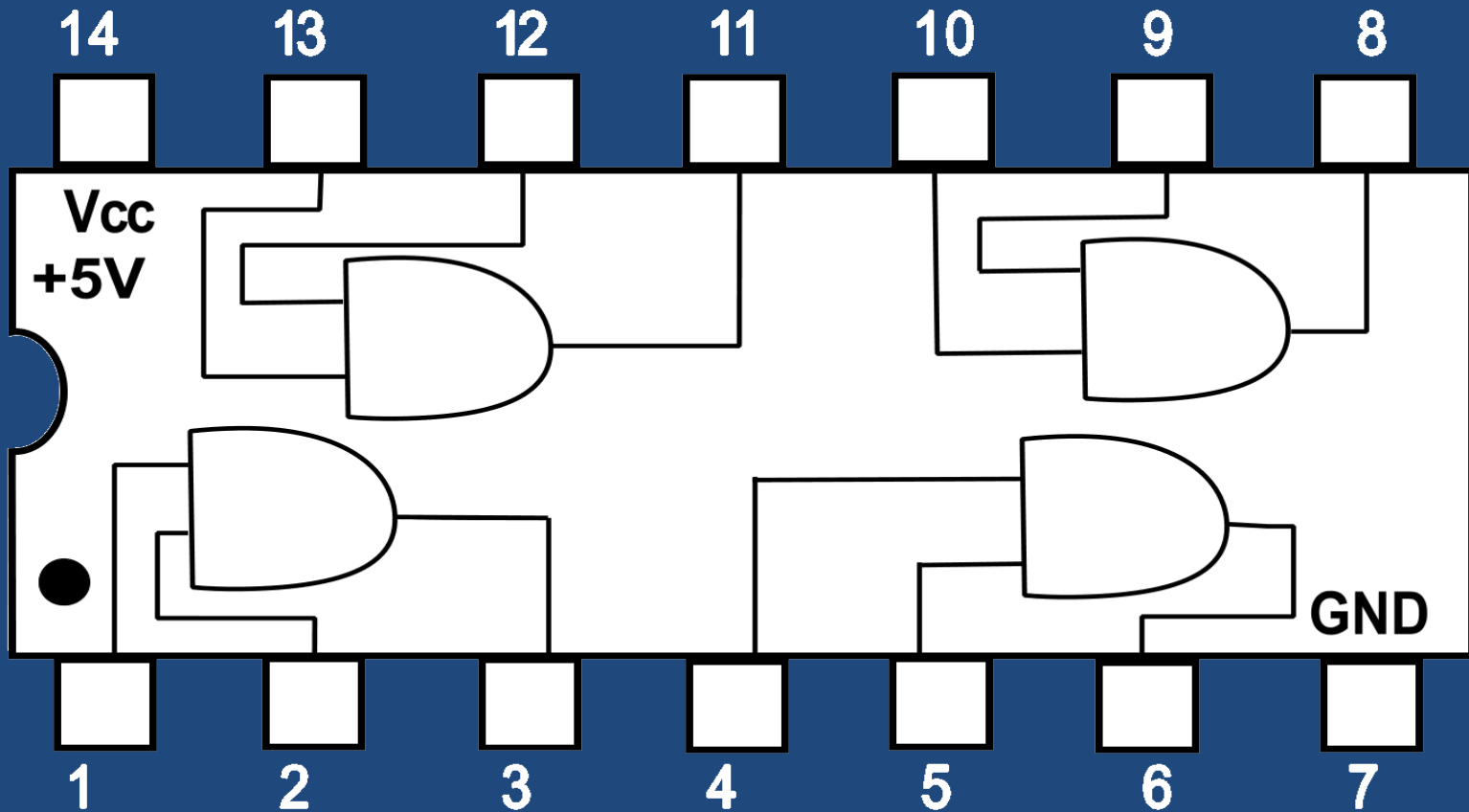


**Fourteen-pin dual in-line package (DIP) IC**



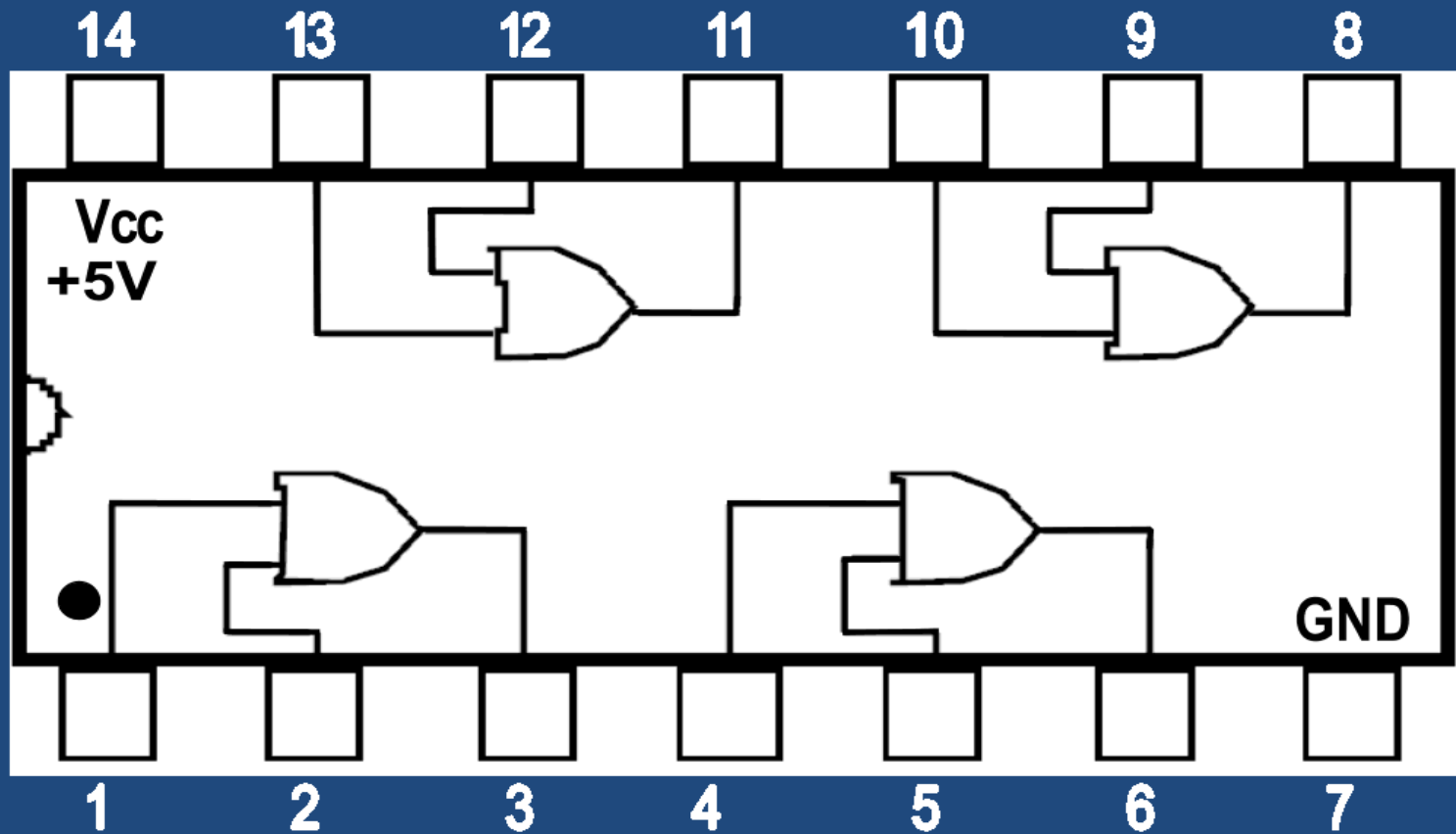
**Eight-pin IC, we use the 741 & 555**

# 7408 Quad Two-input AND



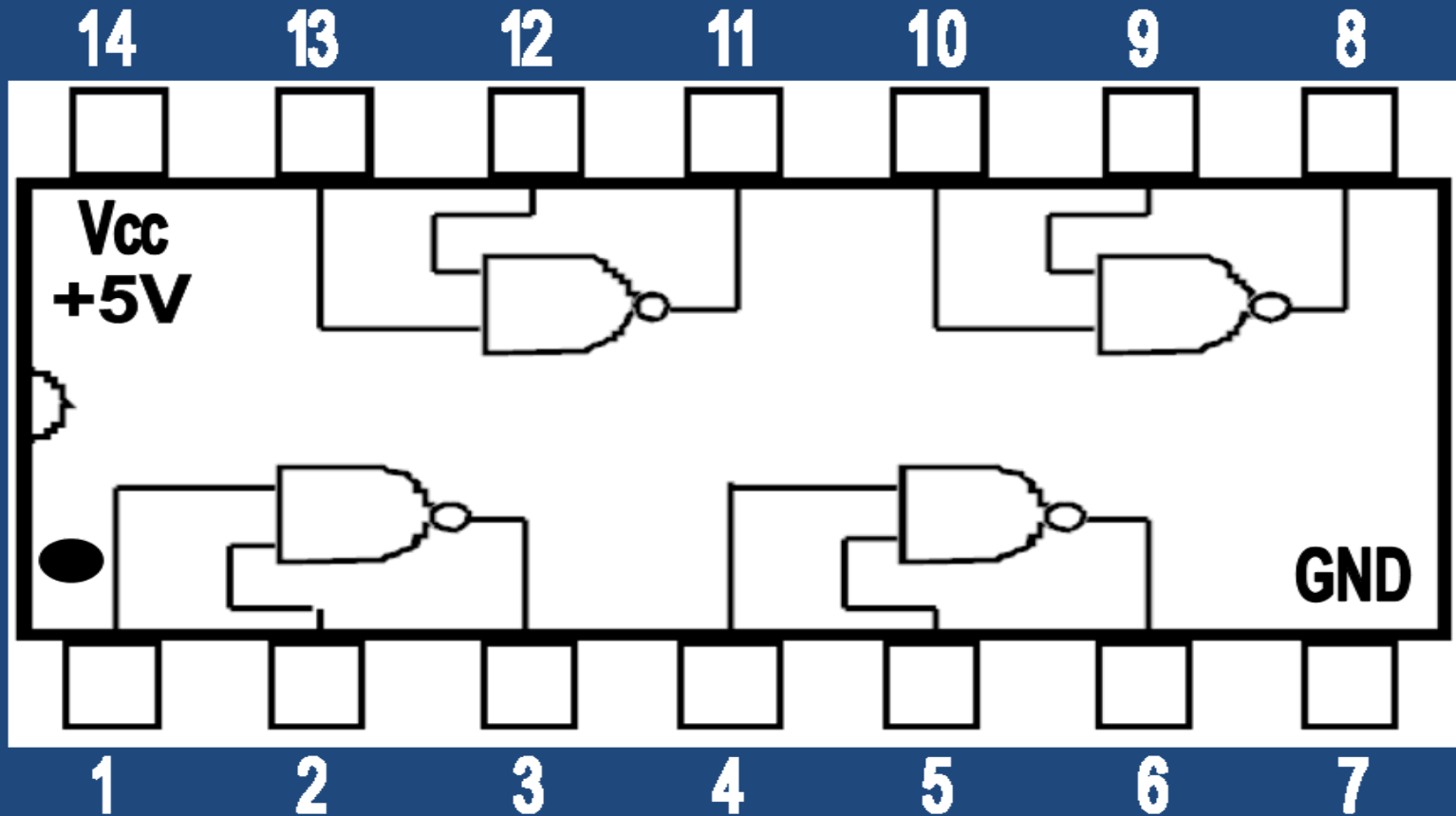
7408 Quad Two-input AND Pinout Diagram

# 7432 Quad Two-input OR



7432 Quad two-input OR Pinout Diagram

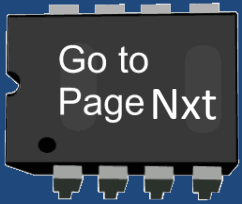
# 7400 Quad Two-input NAND



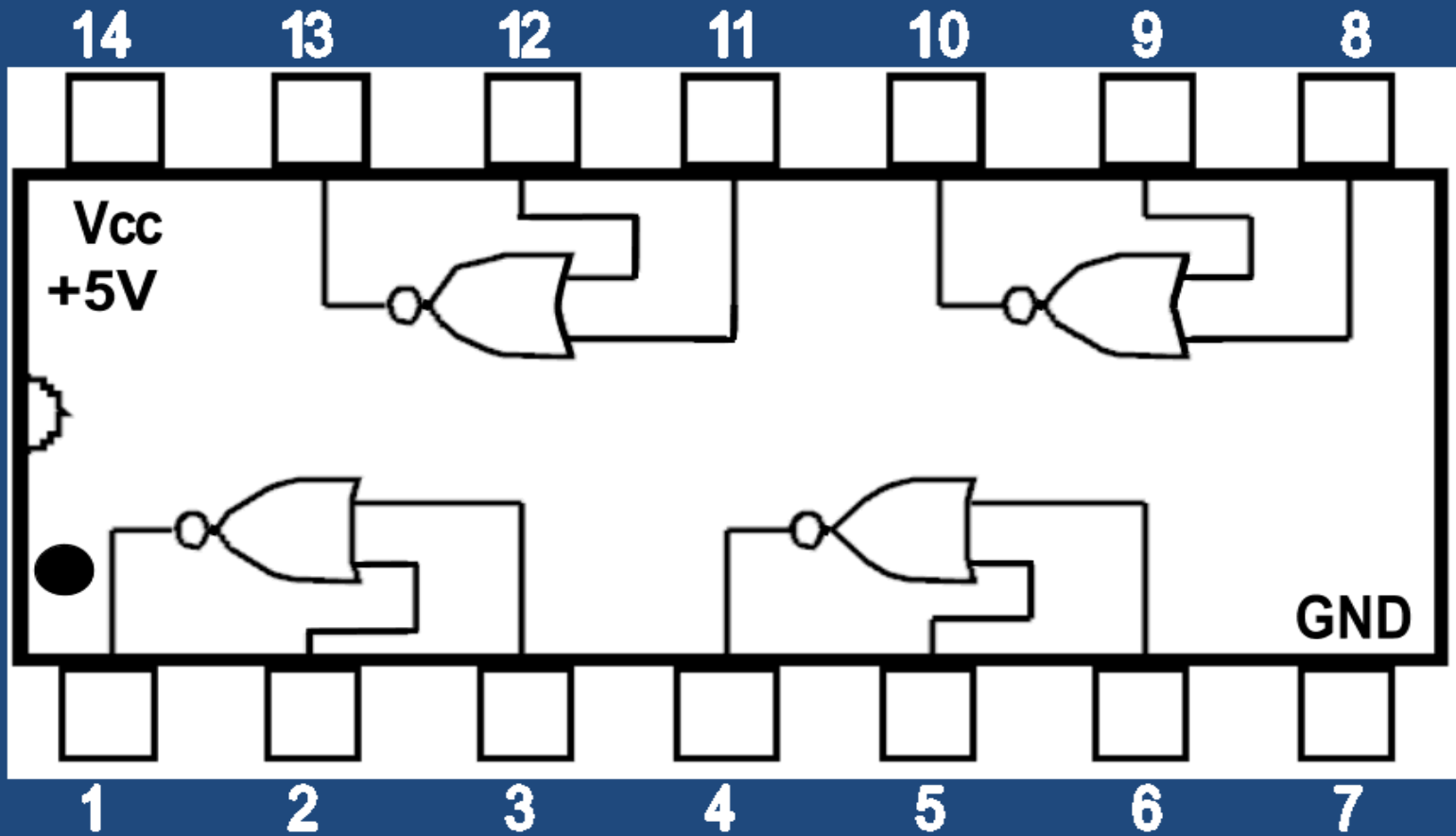
Gate7400 Quad Two-input NAND Gate

# Differences in Pinout Diagrams

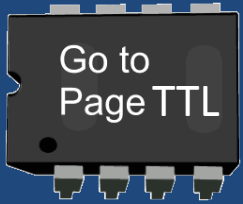
- You must pay attention to the type of IC you are working with.
- The next two diagrams are both Quad Two-input NOR Gates.
  - The difference is that one is a TTL and the other is a CMOS IC.
  - Look at the difference in the Pinout Diagrams.



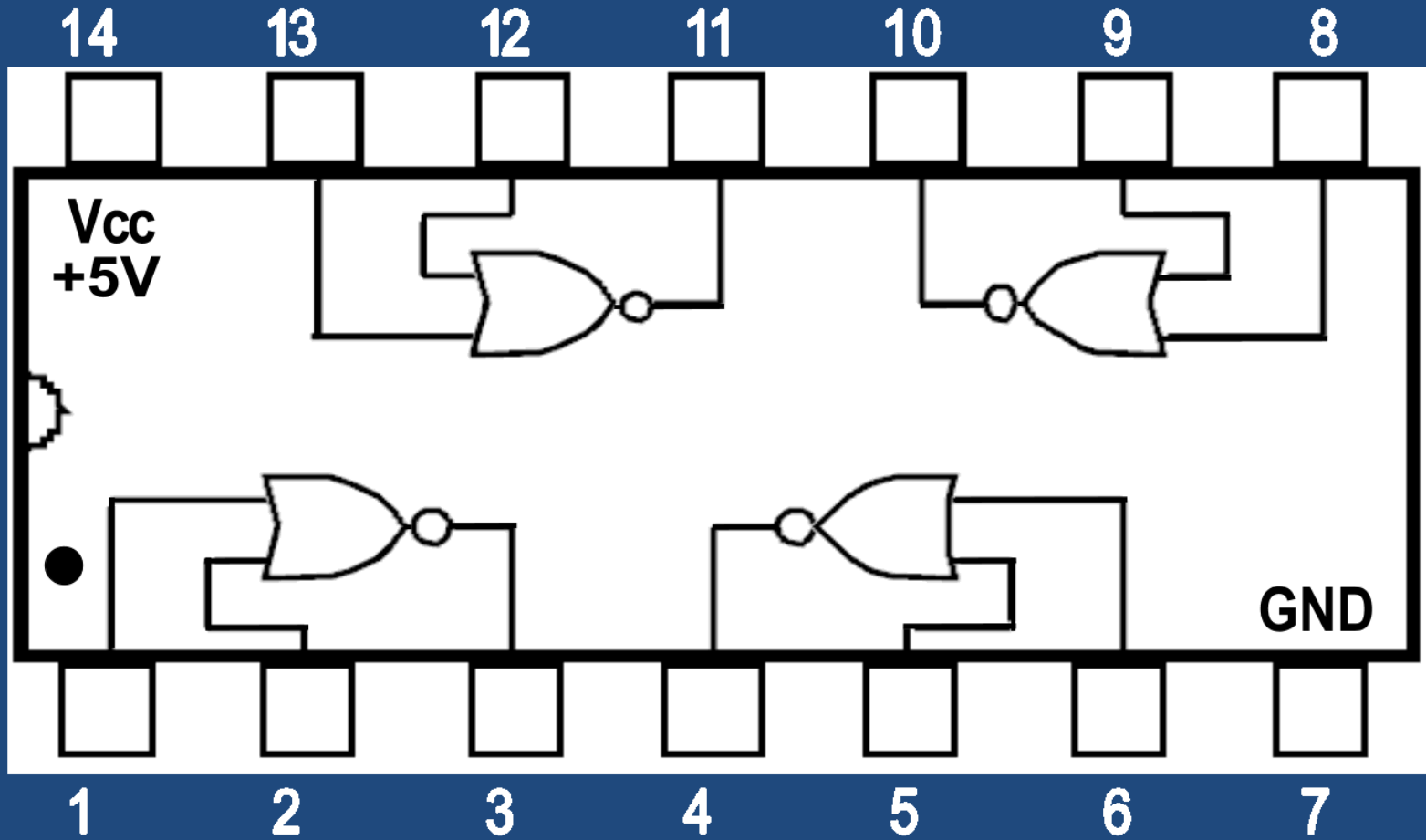
# 7402 Quad Two-input NOR



7402 Quad Two Input Nor Gate Pinout Diagram



# 4001 Quad Two-input CMOS NOR



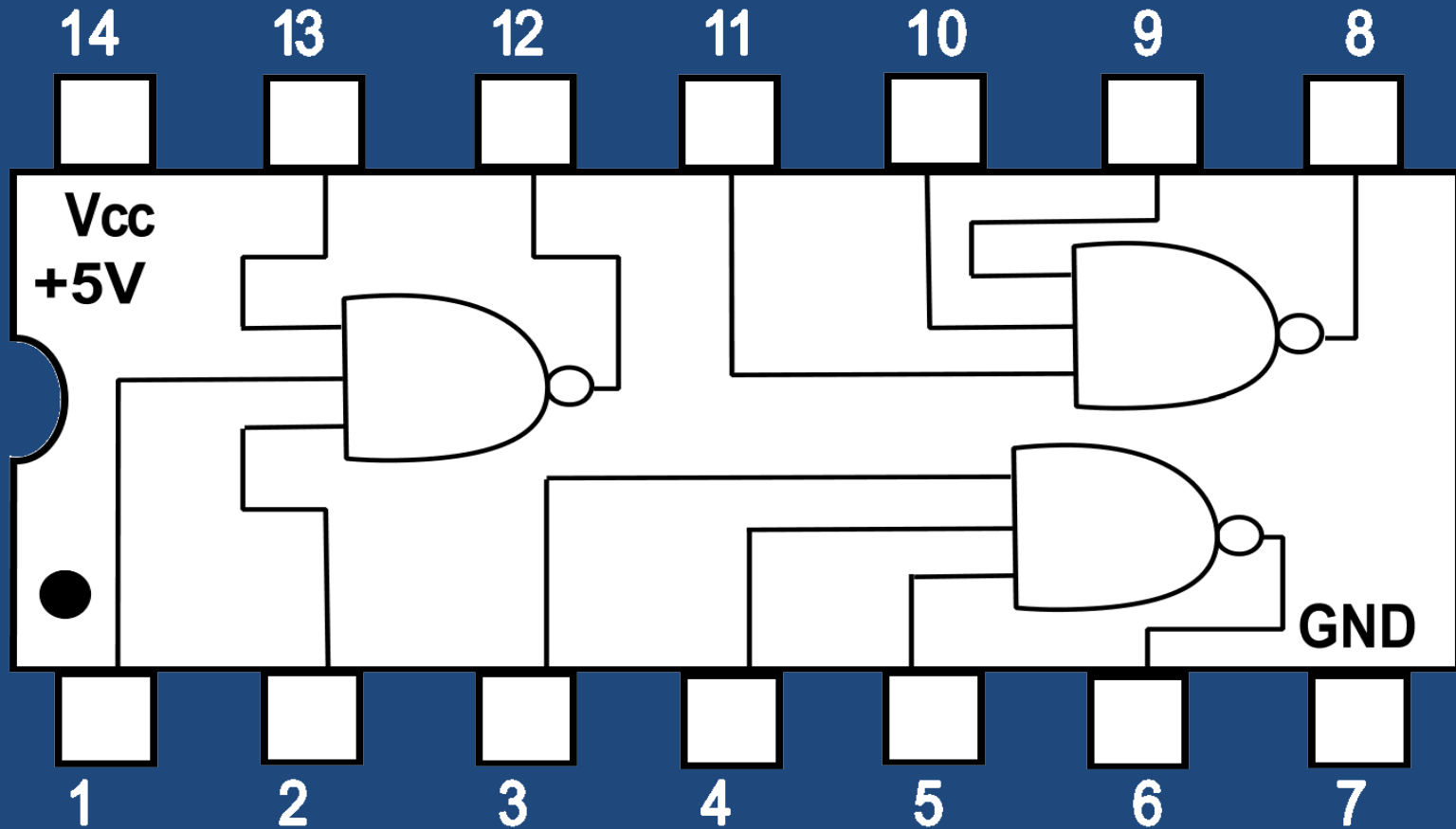
4001 CMOS Quad Two-input NOR Pinout Diagram



# Gates can have more than two inputs

- The following pinout diagram is for a three input NAND Gate IC.
- There are also ICs that have gates with more than three inputs.
- View the TTL Data Book to see a variety of ICs and diagrams.

# 7410 Triple Three-input NAND



7410 Triple Three-input NAND Pinout Diagram

The below link is to download a  
TTL Data Book

You should be able to copy and paste  
the link into a browser to open.

- <http://www.pdf-top.com/view/aHR0cDovL2VjZS13d3cuY29sb3JhZG8uZW R1L35tY2NsdXJlbC9PTI9TZW1pY29uZHVjdG9yX0xTVFRMX0RhdGFfREwxMjEtRC5wZGY>

Questions?



## References

- 3466-1 (Lesson)
- Conan the Librarian. (2003, July 09). *the basics of integrated circuits*. Retrieved from [http://www.solarbotics.net/bftgu/starting\\_elect\\_ic.html](http://www.solarbotics.net/bftgu/starting_elect_ic.html)

- [www.SiliconFarEast.com](http://www.SiliconFarEast.com). (2008). *To-5 package*. Retrieved from <http://www.siliconfareast.com/to5.htm>

**The End.**

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