

ECE231: Electronics Cheatsheet

Dov Kruger

Basic Formulas

Ohm's Law:

$$V = IR$$

$$P = IV = I^2 R = \frac{V^2}{R}$$

Series Resistance:

$$R_{eq} = R_1 + R_2 + R_3 + \dots$$

Parallel Resistance:

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2} \text{ (for 2 resistors)}$$

Capacitor Energy:

$$E = \frac{1}{2} CV^2$$

Series Capacitance:

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots$$

Parallel Capacitance:

$$C_{eq} = C_1 + C_2 + C_3 + \dots$$

RC Circuit Charging:

$$V_C(t) = V_S(1 - e^{-t/\tau})$$

$$I(t) = \frac{V_S}{R} e^{-t/\tau}$$

RC Circuit Discharging:

$$V_C(t) = V_0 e^{-t/\tau}$$

$$I(t) = -\frac{V_0}{R} e^{-t/\tau}$$

where $\tau = RC$ (time constant)

Passive Components

Resistor (US)



Resistor (IEC)



Capacitor



Electrolytic Cap



Battery



Voltage Source



Earth Ground



Signal Ground



LED



Diode



Logic Gates

AND



OR



NOT



NAND



NOR



XOR



Transistors

NPN BJT



PNP BJT



n-MOSFET



p-MOSFET



n-FET

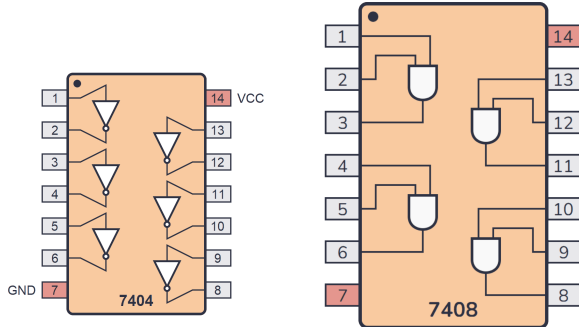


p-FET

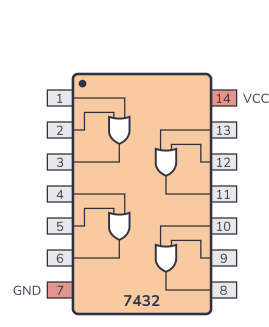


IC Pinouts

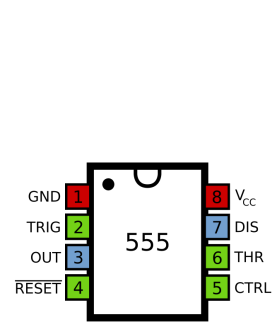
7404 (Hex Inverter) 7408 (Quad AND)



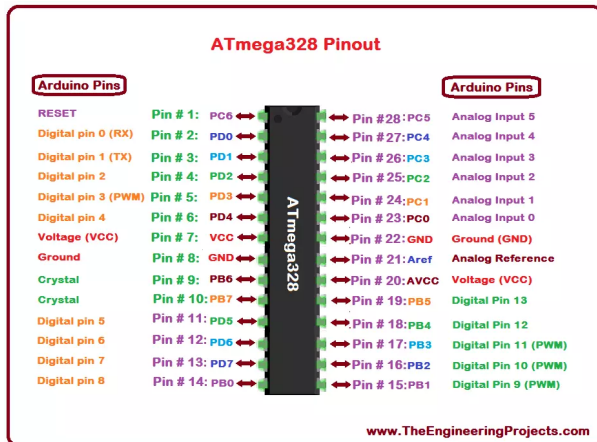
7432 (Quad OR)



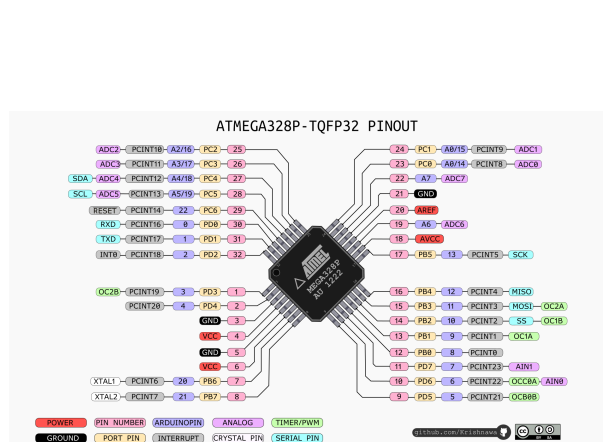
555 Timer



ATmega328 (DIP)



ATmega328 (Quad)



Common Values

- **Resistor Colors:** Black(0), Brown(1), Red(2), Orange(3), Yellow(4), Green(5), Blue(6), Violet(7), Gray(8), White(9)
- **Standard Resistors:** 1.0, 1.2, 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8, 8.2 ($\times 10^n$)

Power Supply

- **TTL Logic:** $V_{CC} = 5V$, $V_{SS} = 0V$
- **CMOS Logic:** $V_{DD} = 3.3V$ or $5V$, $V_{SS} = 0V$
- **Arduino:** $5V$, $3.3V$, GND