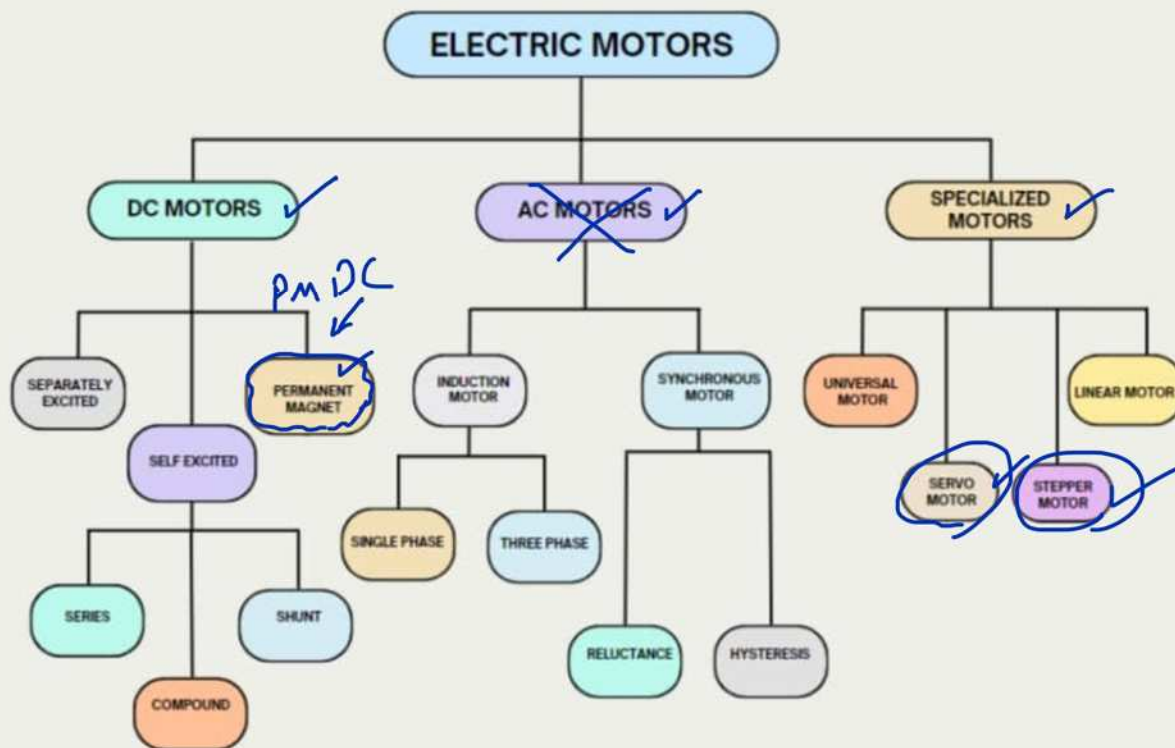
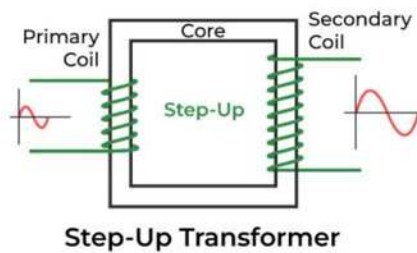
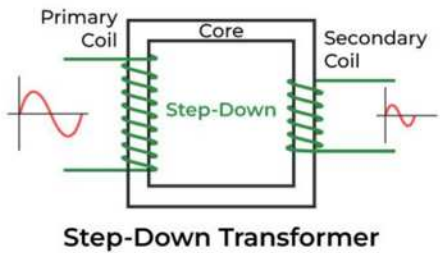
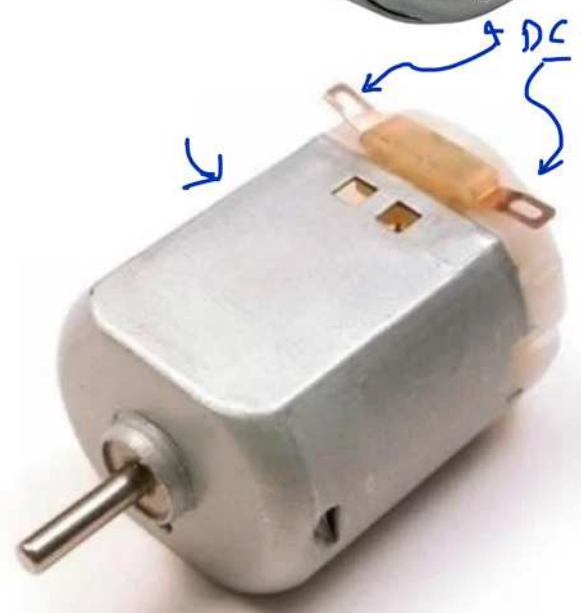
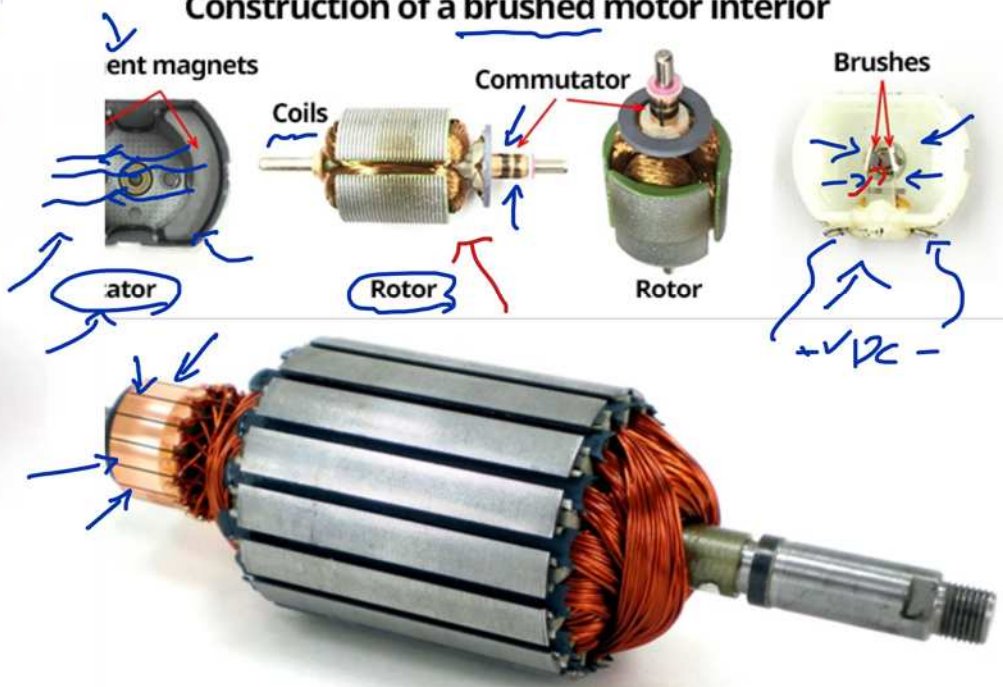


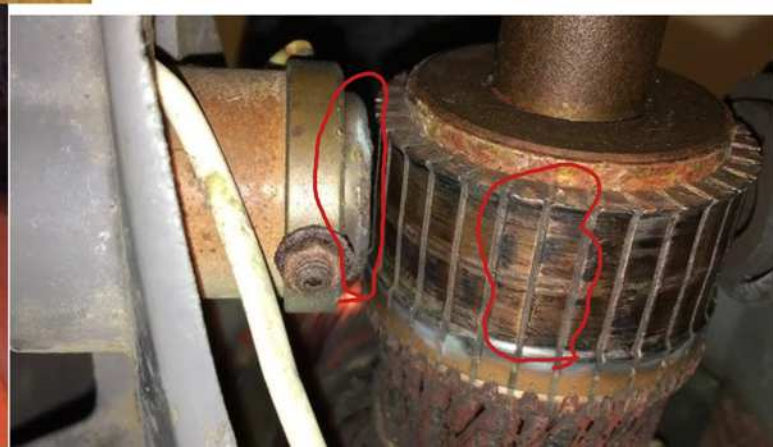
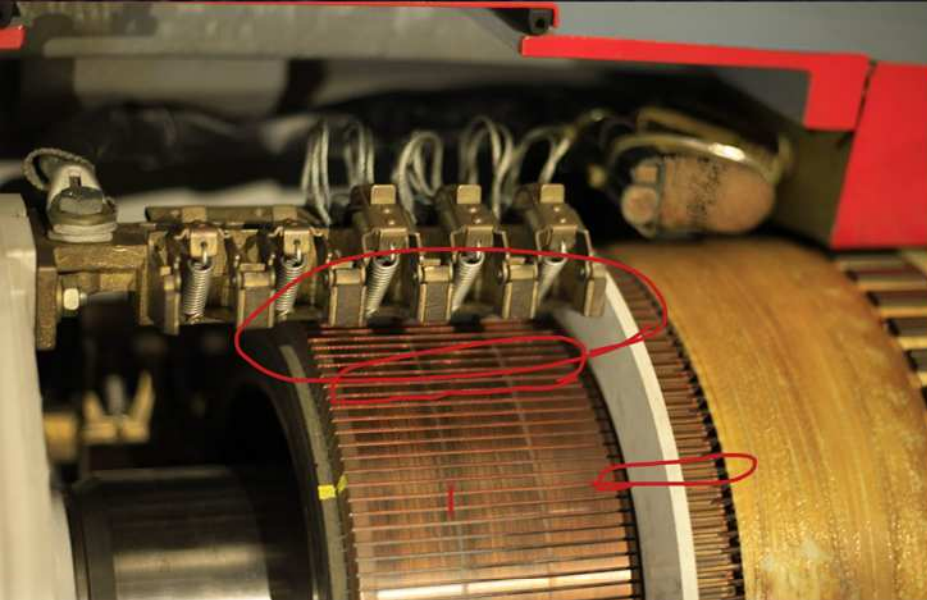
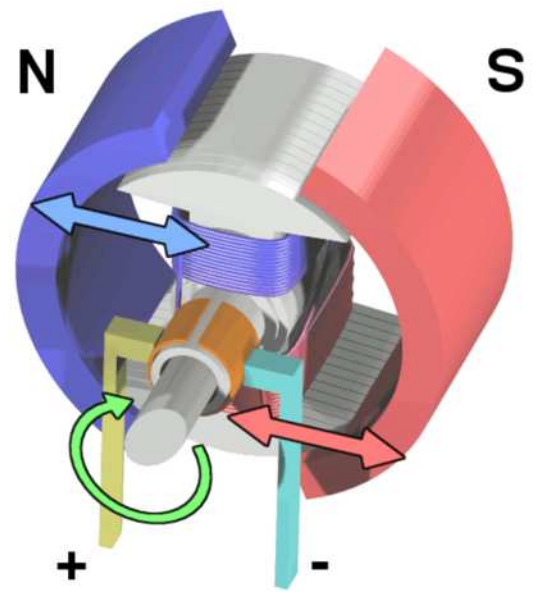
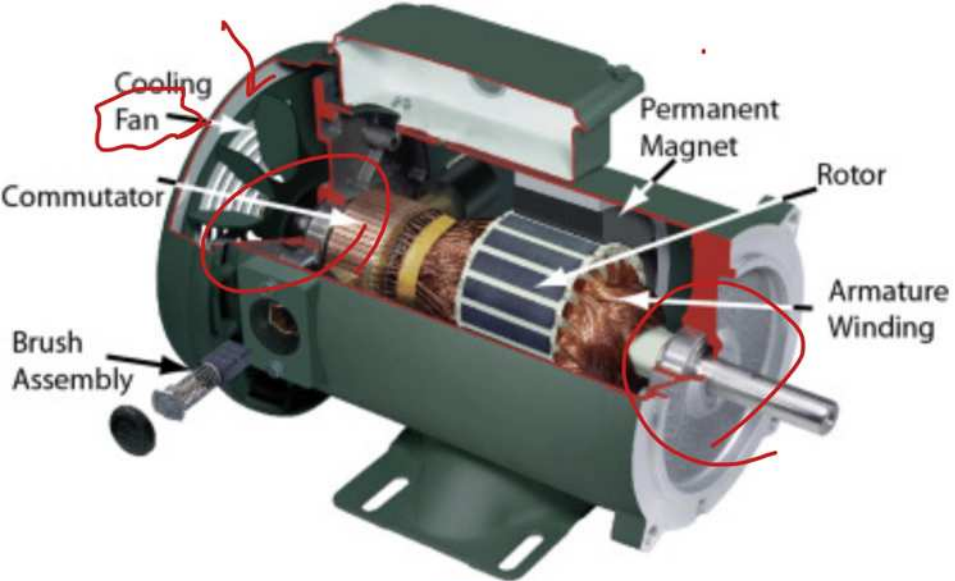
Types of Transformer

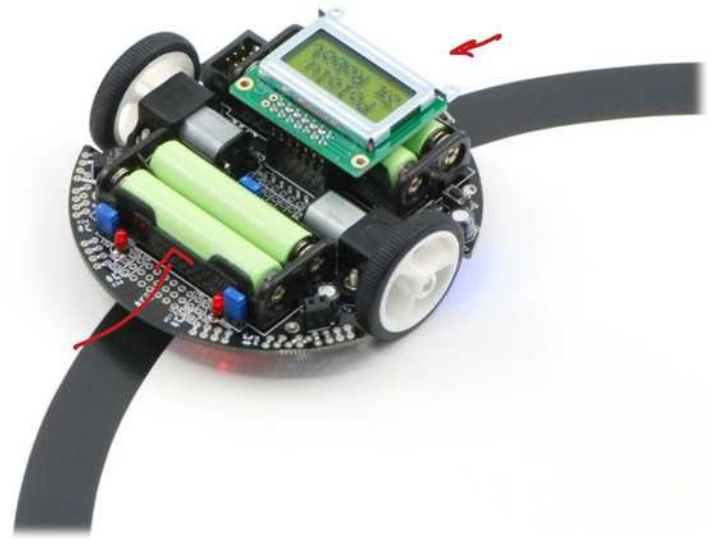


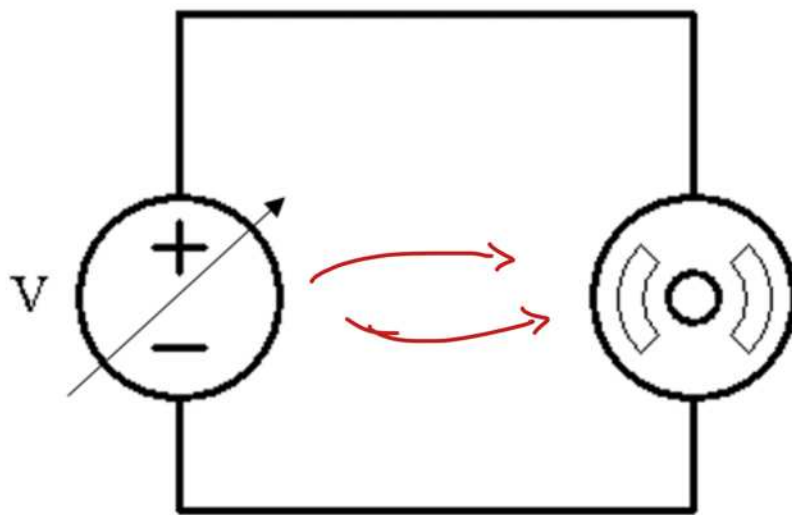


Construction of a brushed motor interior









motor

$$R = 10 \Omega, L = 3.1 \text{ mH}$$

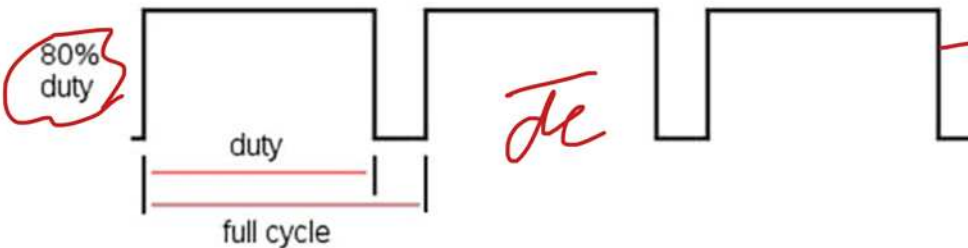
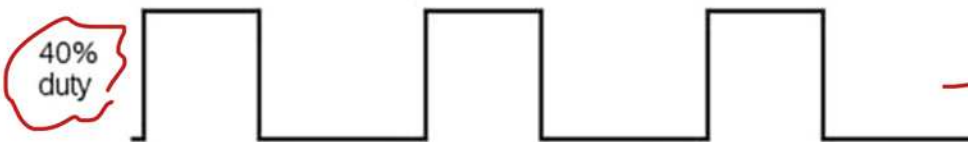
$$Z = \frac{L}{R} = \frac{3.1 \times 10^{-3}}{10}$$

$$Z = 310 \mu\text{s}$$

$$f_c = \frac{1}{2\pi Z} = \frac{1}{2 \times 3.14 \times 310 \times 10^{-6}}$$

$$f_c = 513 \text{ Hz}$$

pwm

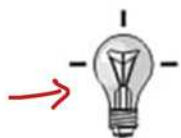


f_c



$f_{pwm} > f_c$
speed \downarrow

$$f_{pwm} \approx 550 \text{ Hz}$$



$$f_{pwm} \approx 5 f_c$$

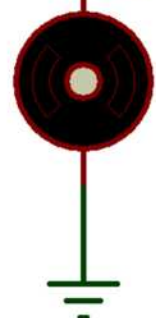
$$f_{pw} = 5 \times 550$$

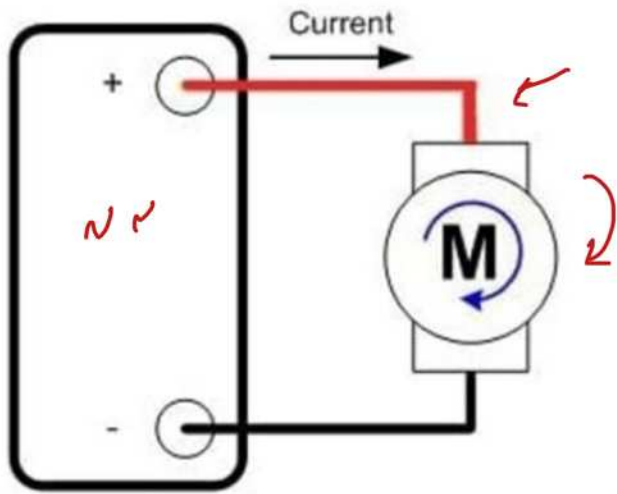
$$f_{pwm} \approx 2750 \text{ Hz}$$

U1

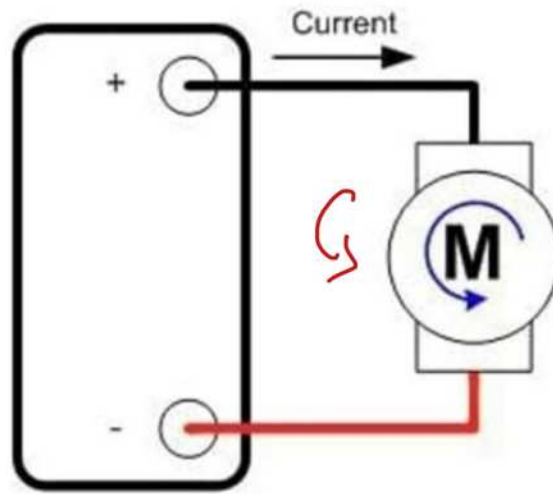
30	PD0/RXD/PCINT16	PB0/ICP1/CLKO/PCINT0	12
31	PD1/TXD/PCINT17	PB1/OC1A/PCINT1	13
32	PD2/INT0/PCINT18	PB2/SS/OC1B/PCINT2	14
1	PD3/INT1/OC2B/PCINT19	PB3/MOSI/OC2A/PCINT3	15
2	PD4/T0/XCK/PCINT20	PB4/MISO/PCINT4	16
9	PD5/T1/OC0B/PCINT21	PB5/SCK/PCINT5	17
10	PD6/AIN0/OC0A/PCINT22	PB6/TOSC1/XTAL1/PCINT6	7
11	PD7/AIN1/PCINT23	PB7/TOSC2/XTAL2/PCINT7	8
20	AREF	PC0/ADC0/PCINT8	23
18	AVCC	PC1/ADC1/PCINT9	24
19	ADC6	PC2/ADC2/PCINT10	25
22	ADC7	PC3/ADC3/PCINT11	26
		PC4/ADC4/SDA/PCINT12	27
		PC5/ADC5/SCL/PCINT13	28
		PC6/RESET/PCINT14	29

ATMEGA328P

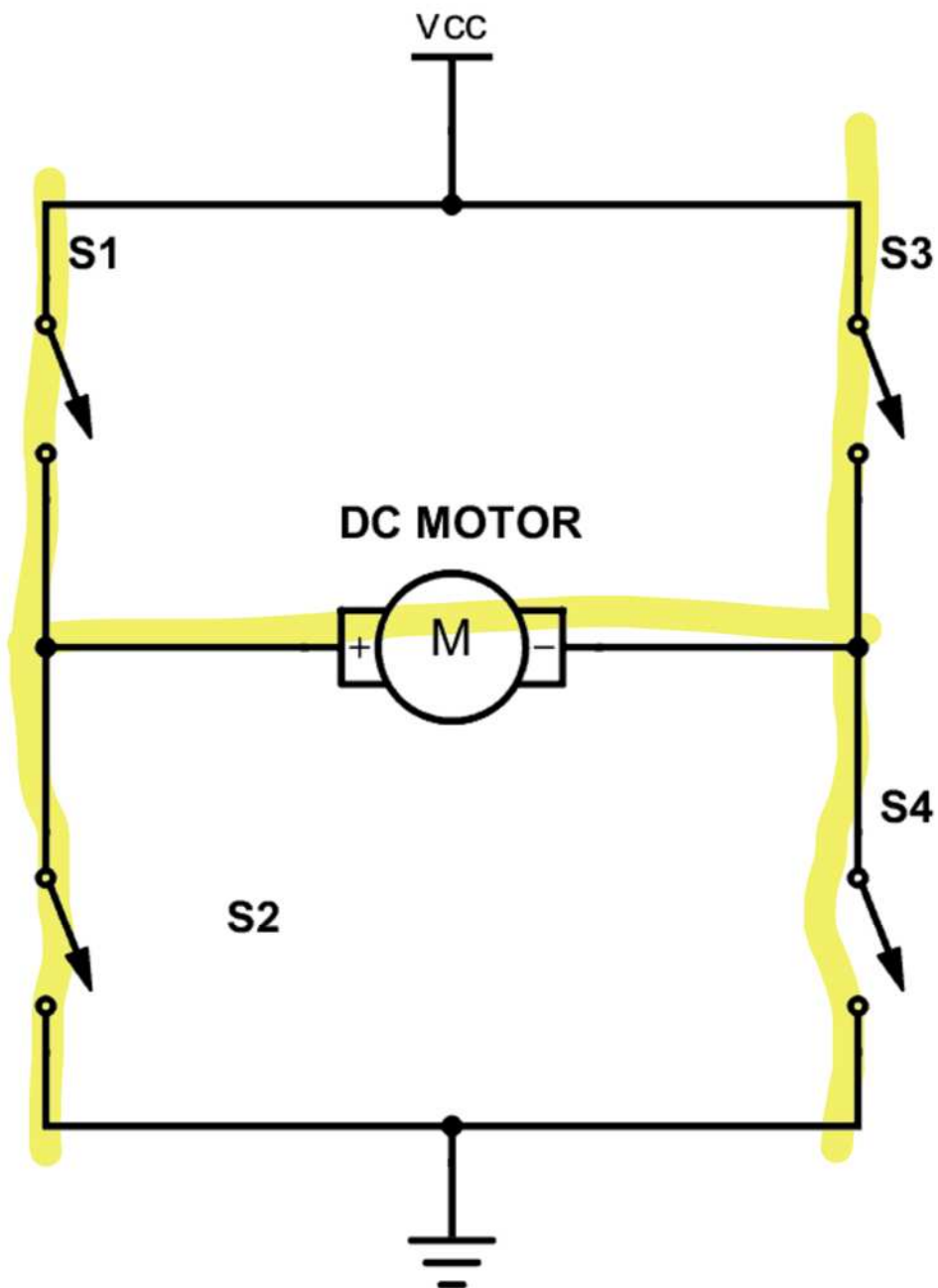


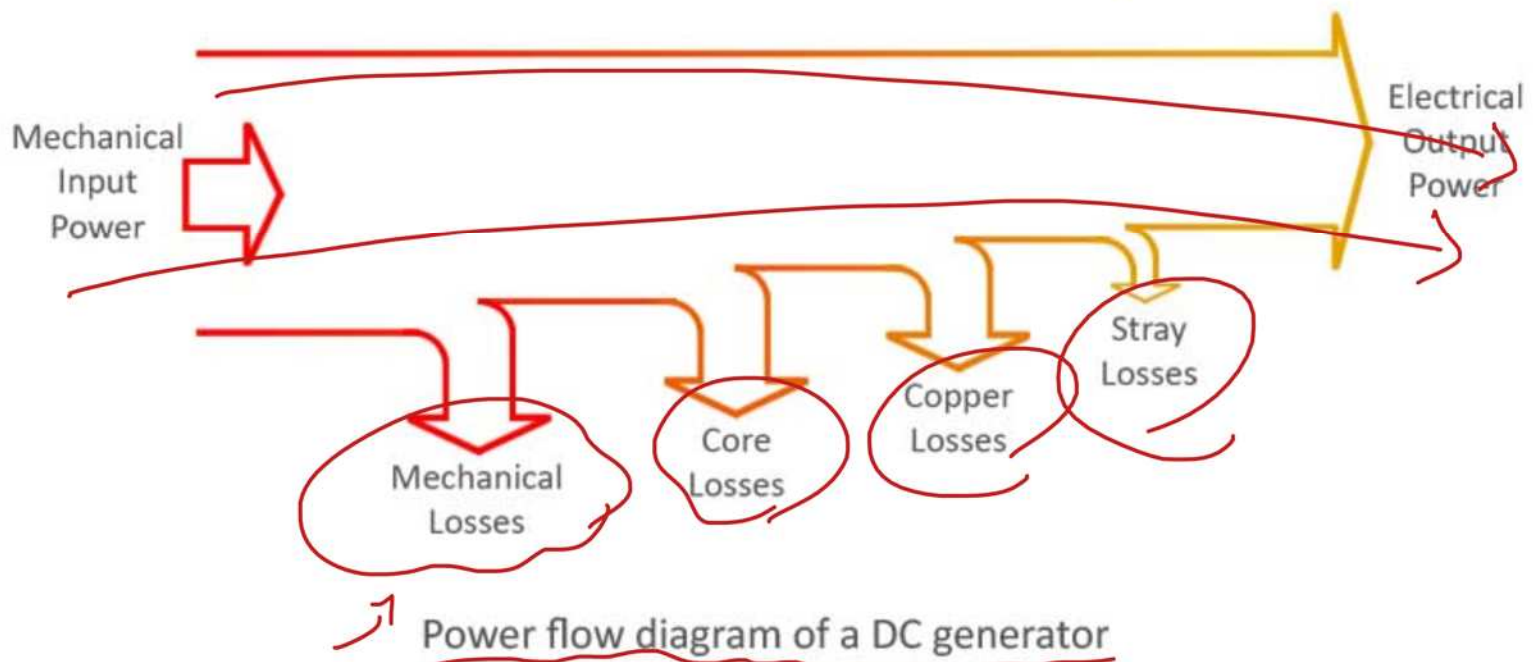
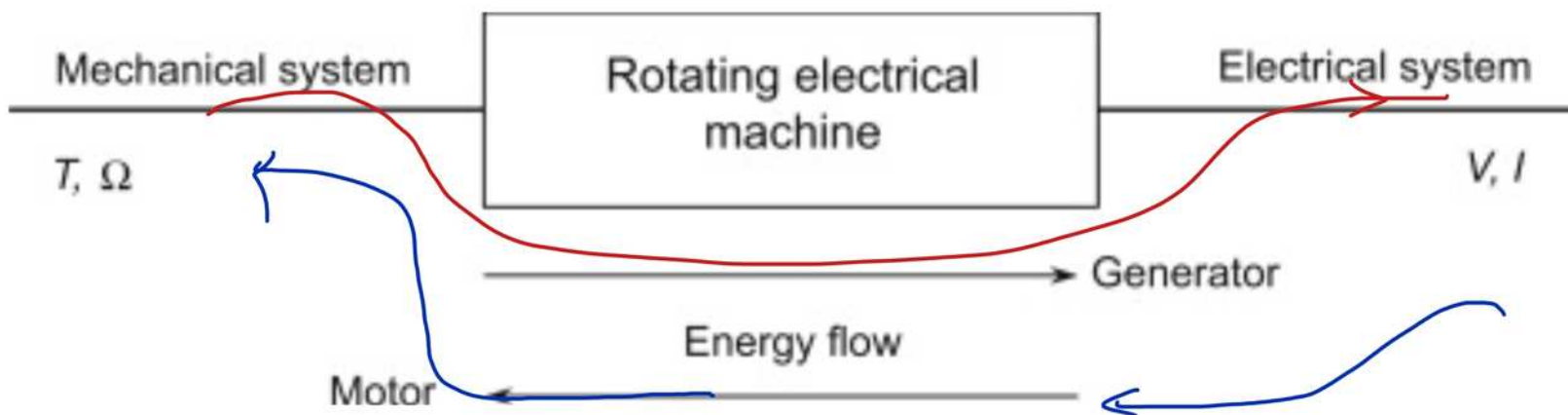
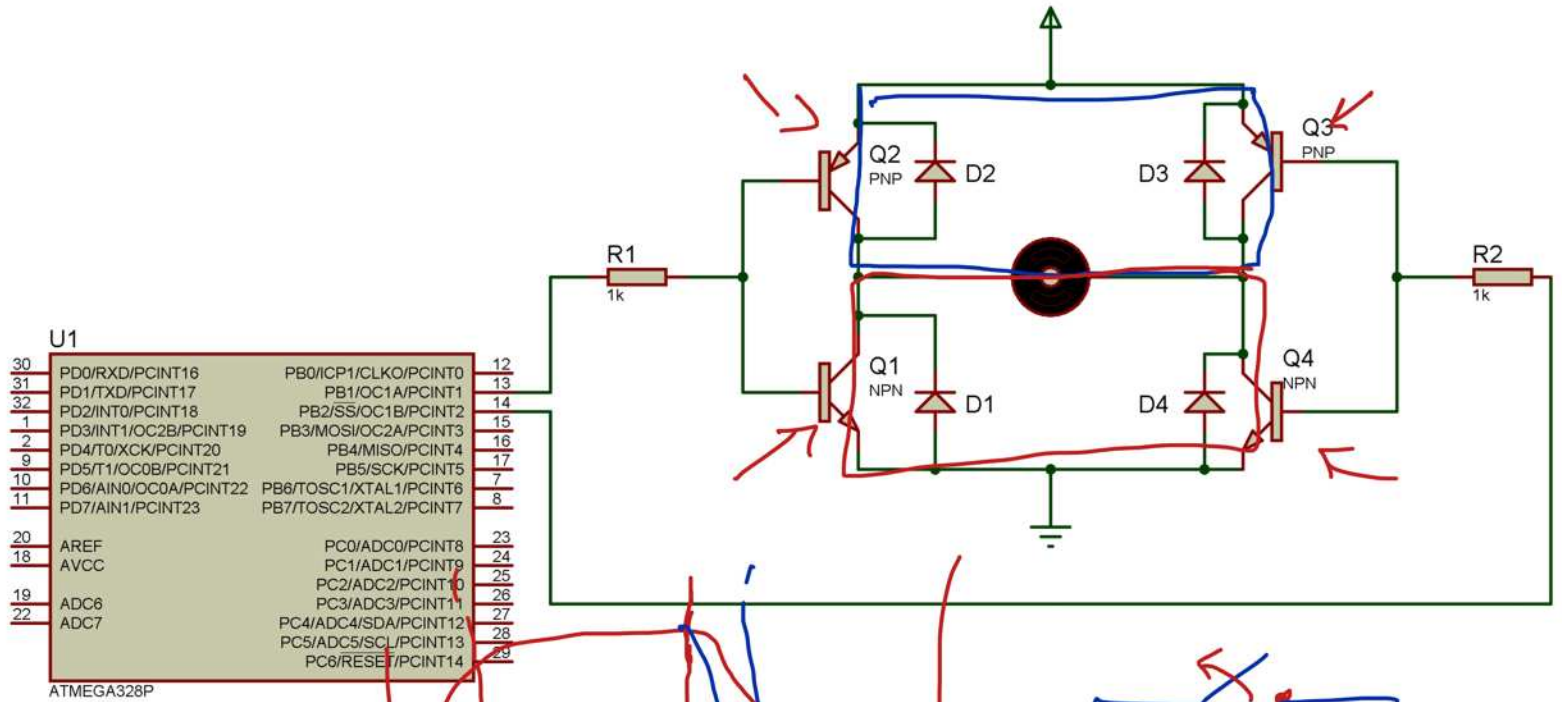


Positive Polarity
Clockwise rotation



Negative Polarity
Counter - Clockwise rotation



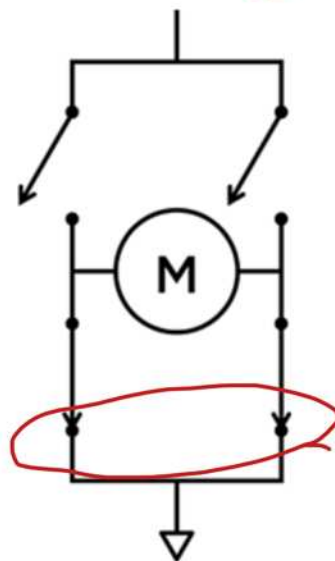
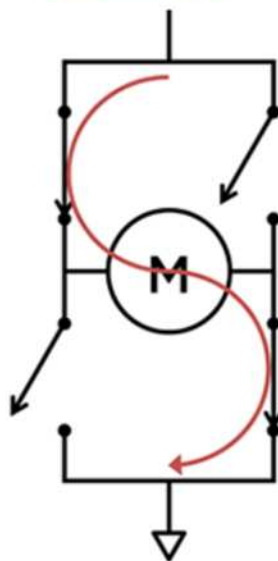
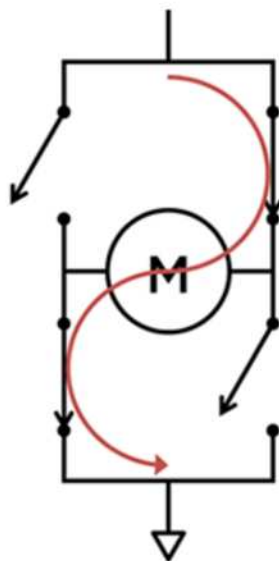
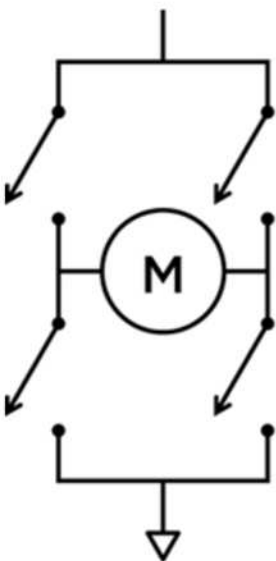


Open

Forward

Backward

Braking



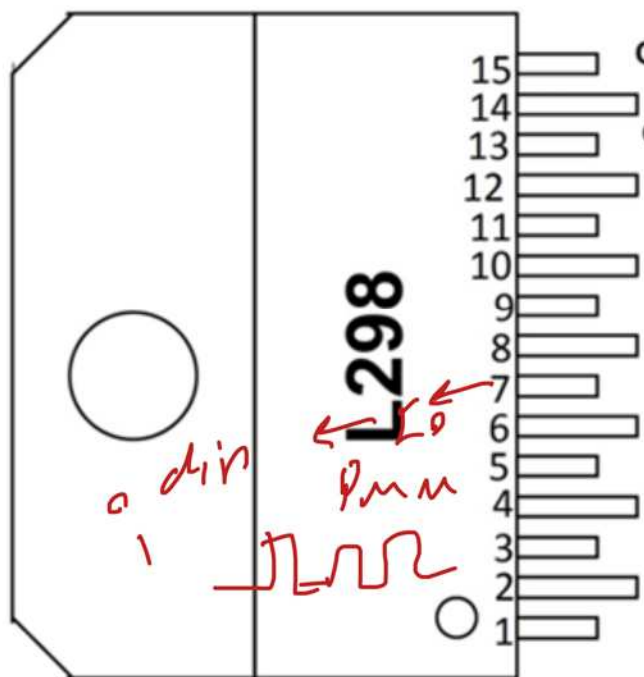
L298



THT



SMD



CURRENT SENSING B

OUTPUT 4

OUTPUT 3

INPUT 4

ENABLE B

INPUT 3

LOGIC SUPPLY VOLTAGE VSS

GND

INPUT 2

ENABLE A

INPUT 1

SUPPLY VOLTAGE VS

OUTPUT 2

OUTPUT 1

CURRENT SENSING A

2xPMD

± 12 4 out

± 12

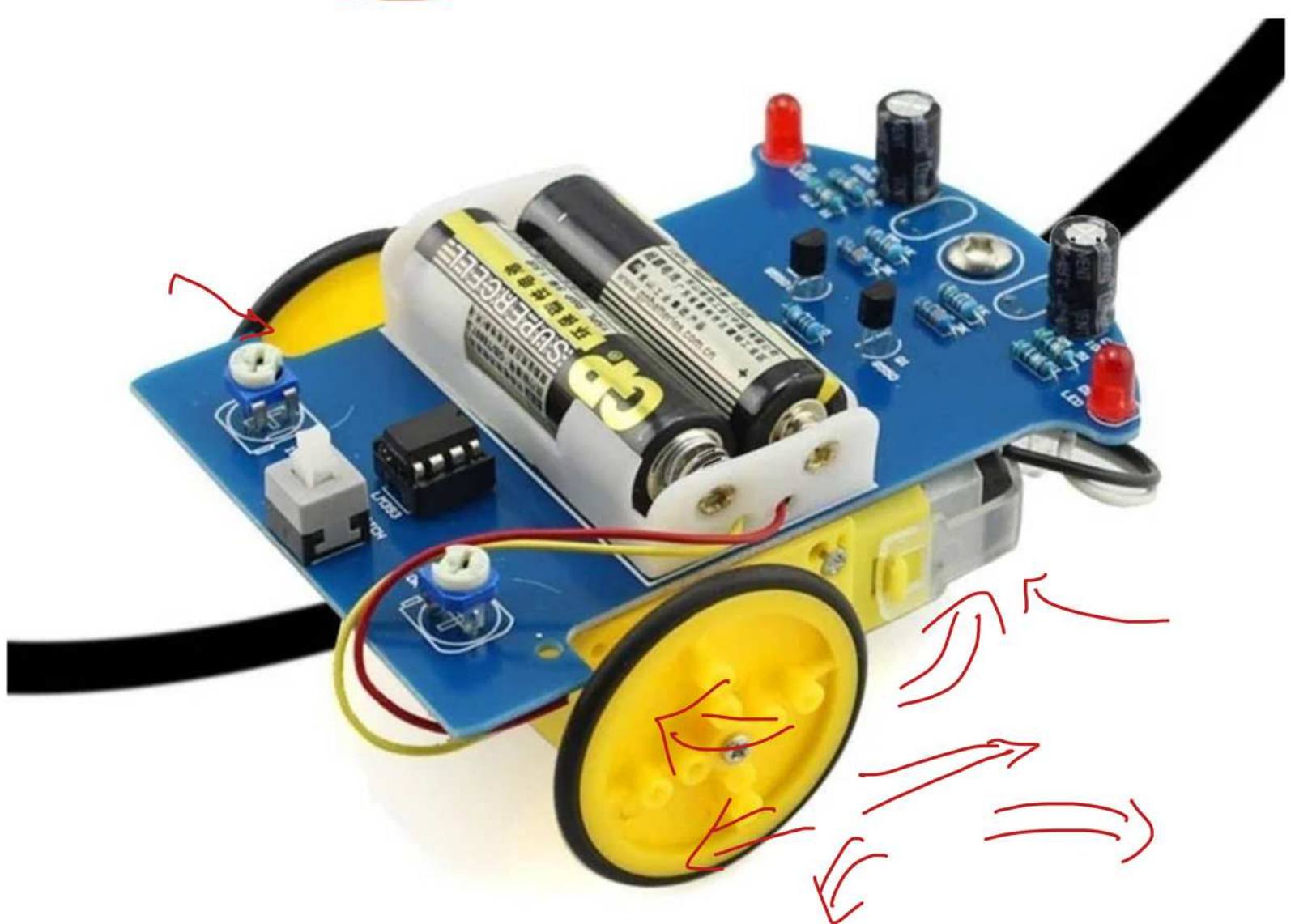
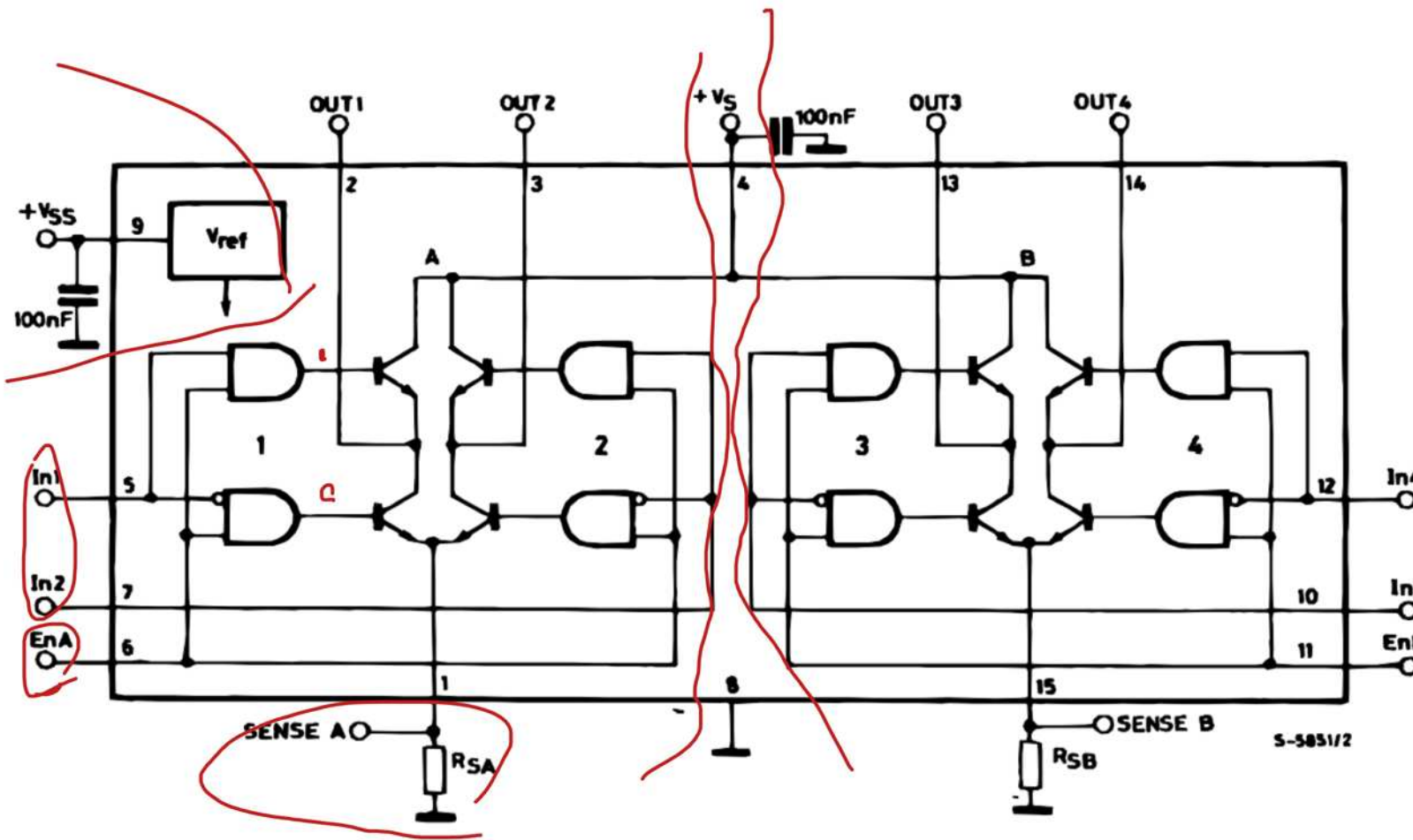
± 12

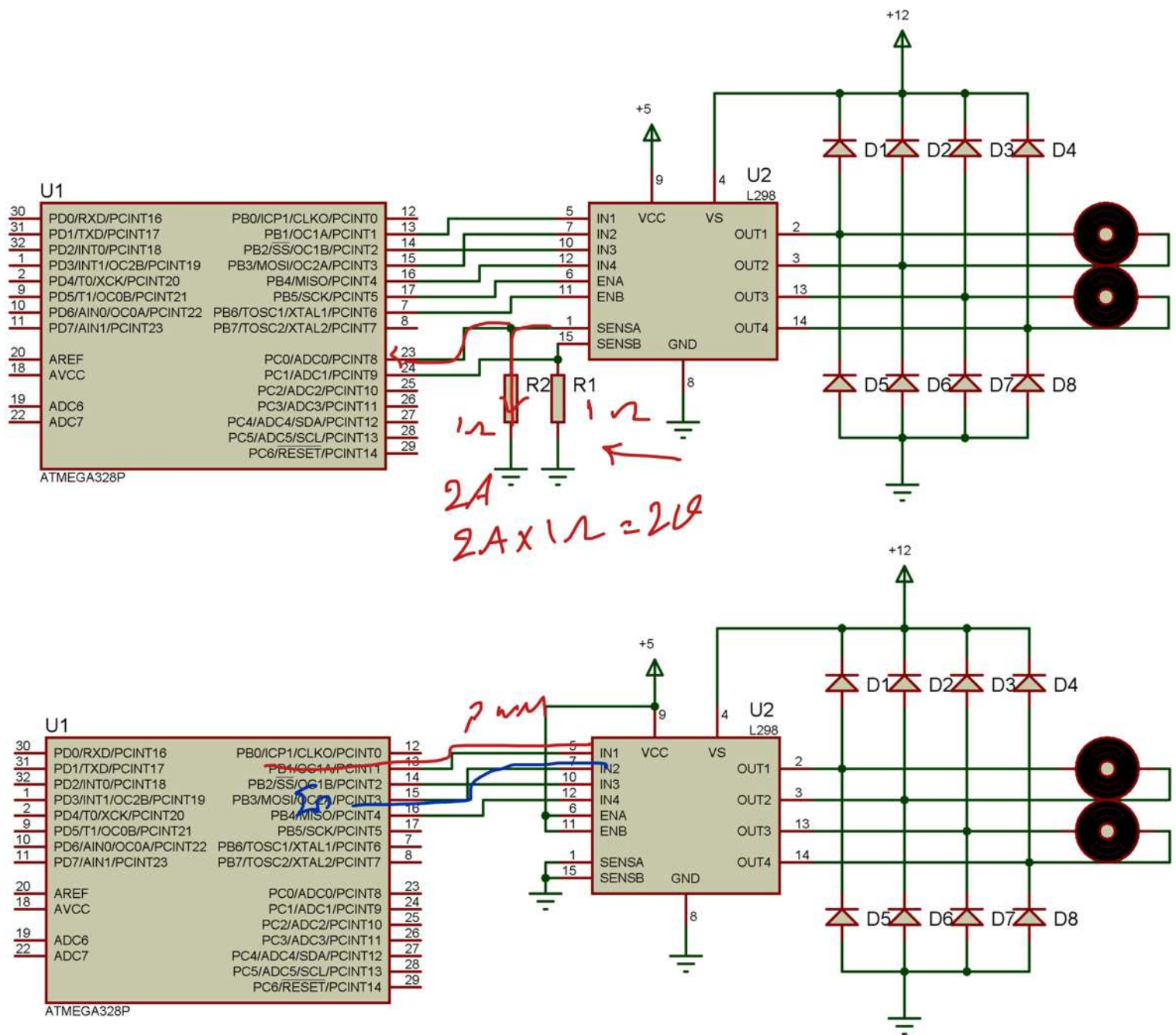
± 12

$V_{SS} = 5$

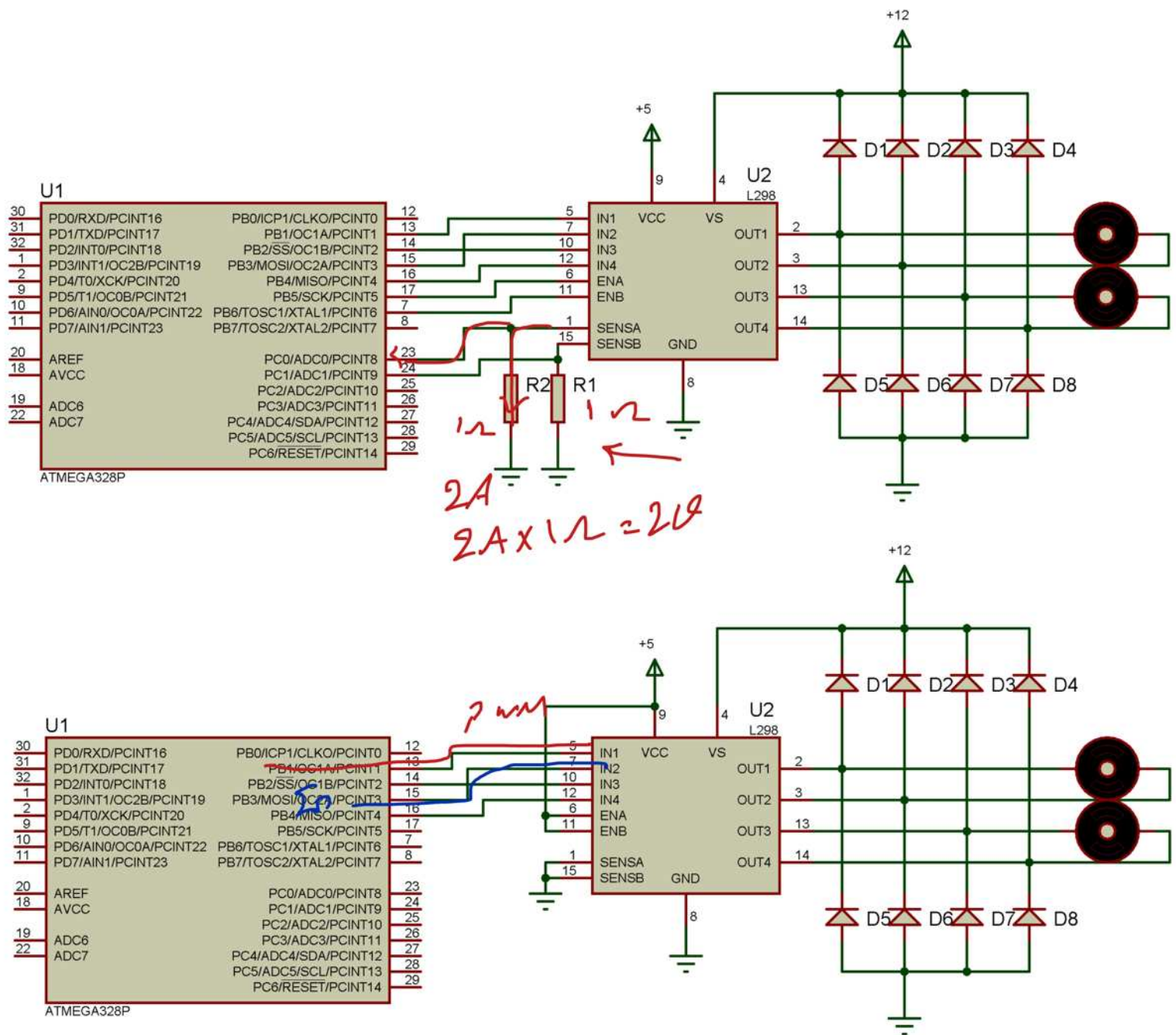
$V_M = 12$

o dir
1
L298
PMD

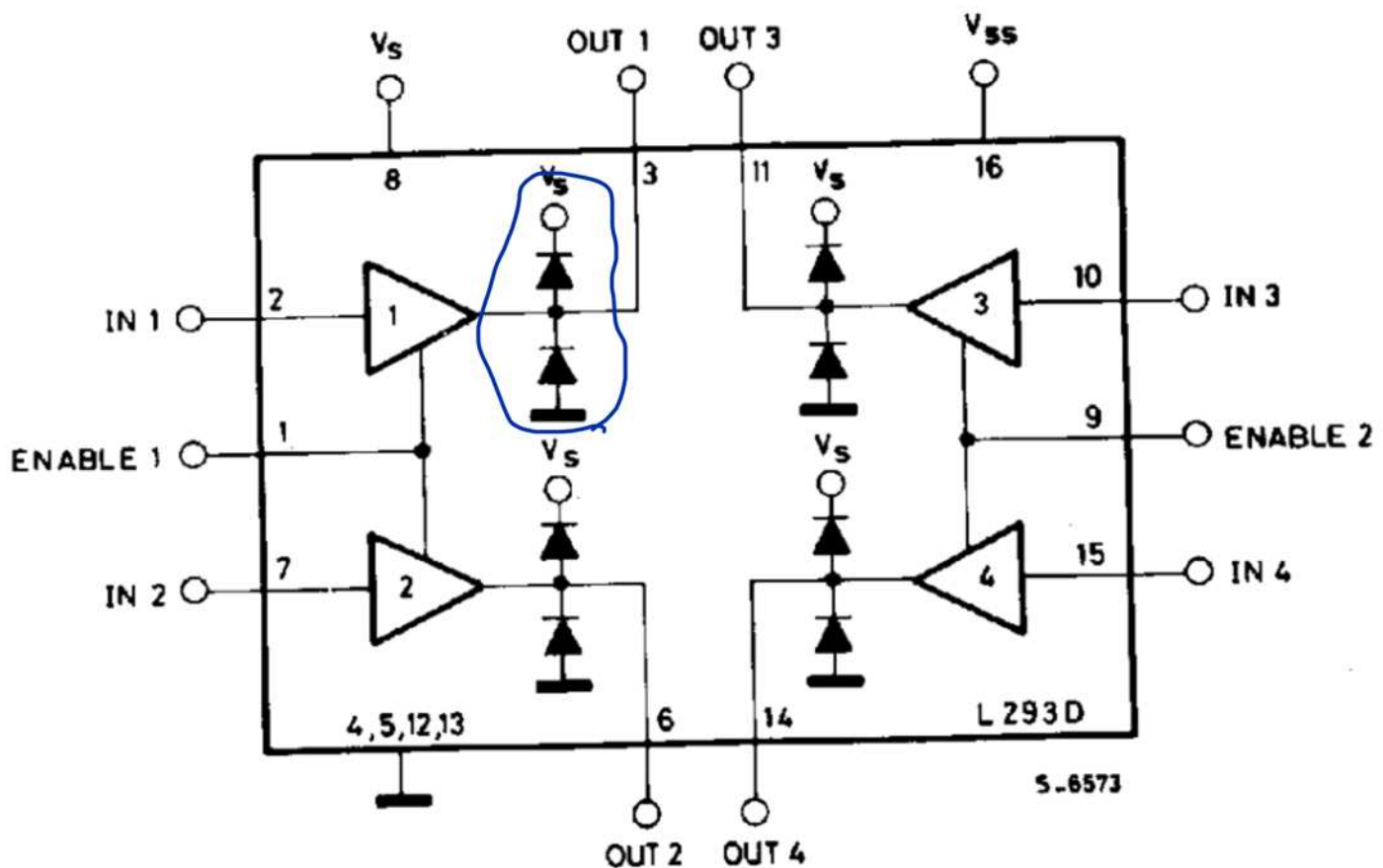
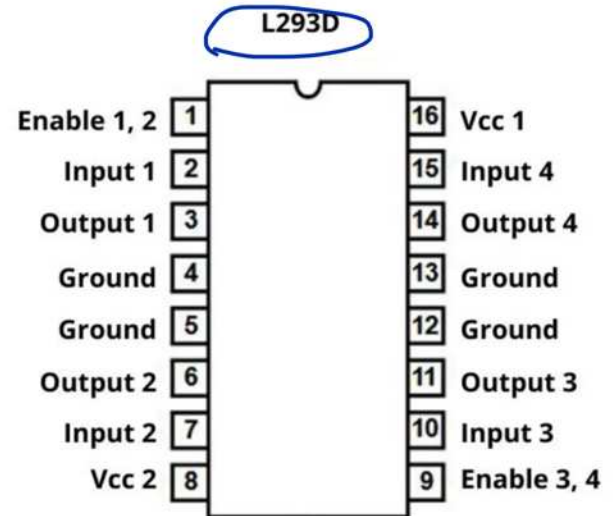




Symbol	Parameter	Value	Unit
V_S	Power Supply	50	V
V_{SS}	Logic Supply Voltage	7	V
V_I, V_{en}	Input and Enable Voltage	-0.3 to 7	V
I_O	Peak Output Current (each Channel) – Non Repetitive ($t = 100\mu s$) – Repetitive (80% on –20% off; $t_{on} = 10ms$) – DC Operation	3 2.5 2	A A A
V_{sens}	Sensing Voltage	-1 to 2.3	V
P_{tot}	Total Power Dissipation ($T_{case} = 75^\circ C$)	25	W
T_{op}	Junction Operating Temperature	-25 to 130	$^\circ C$
T_{stg}, T_j	Storage and Junction Temperature	-40 to 150	$^\circ C$



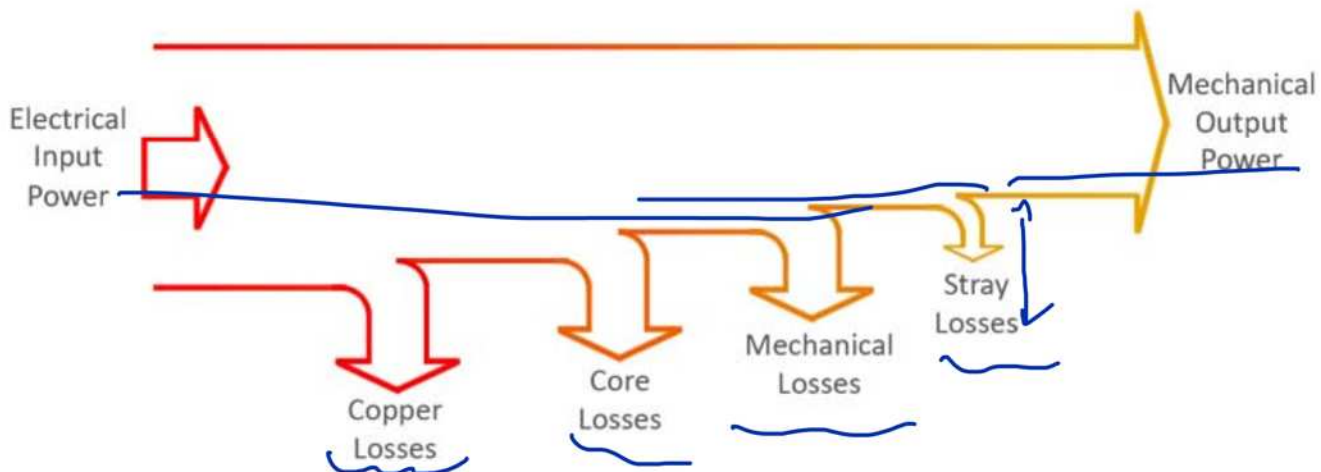
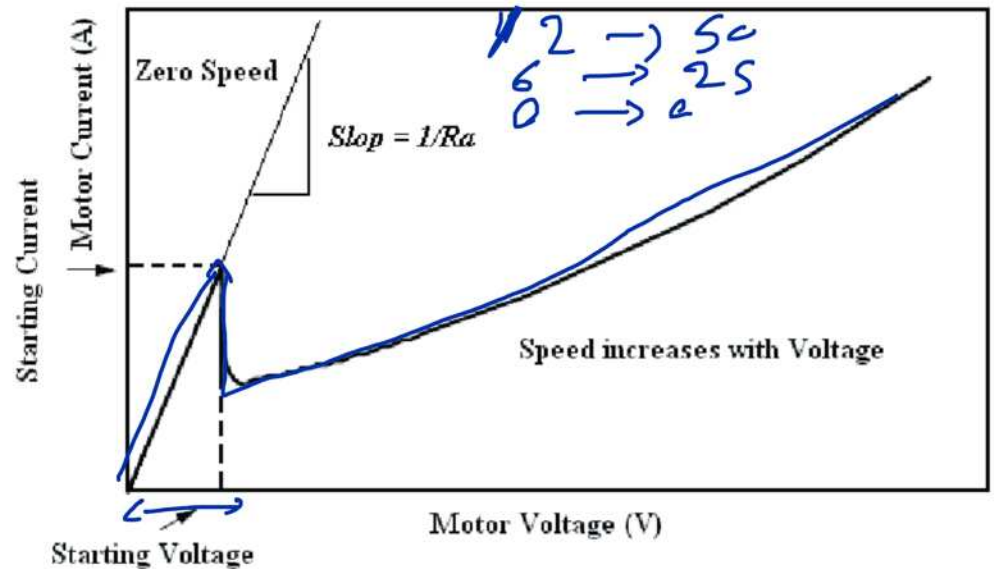
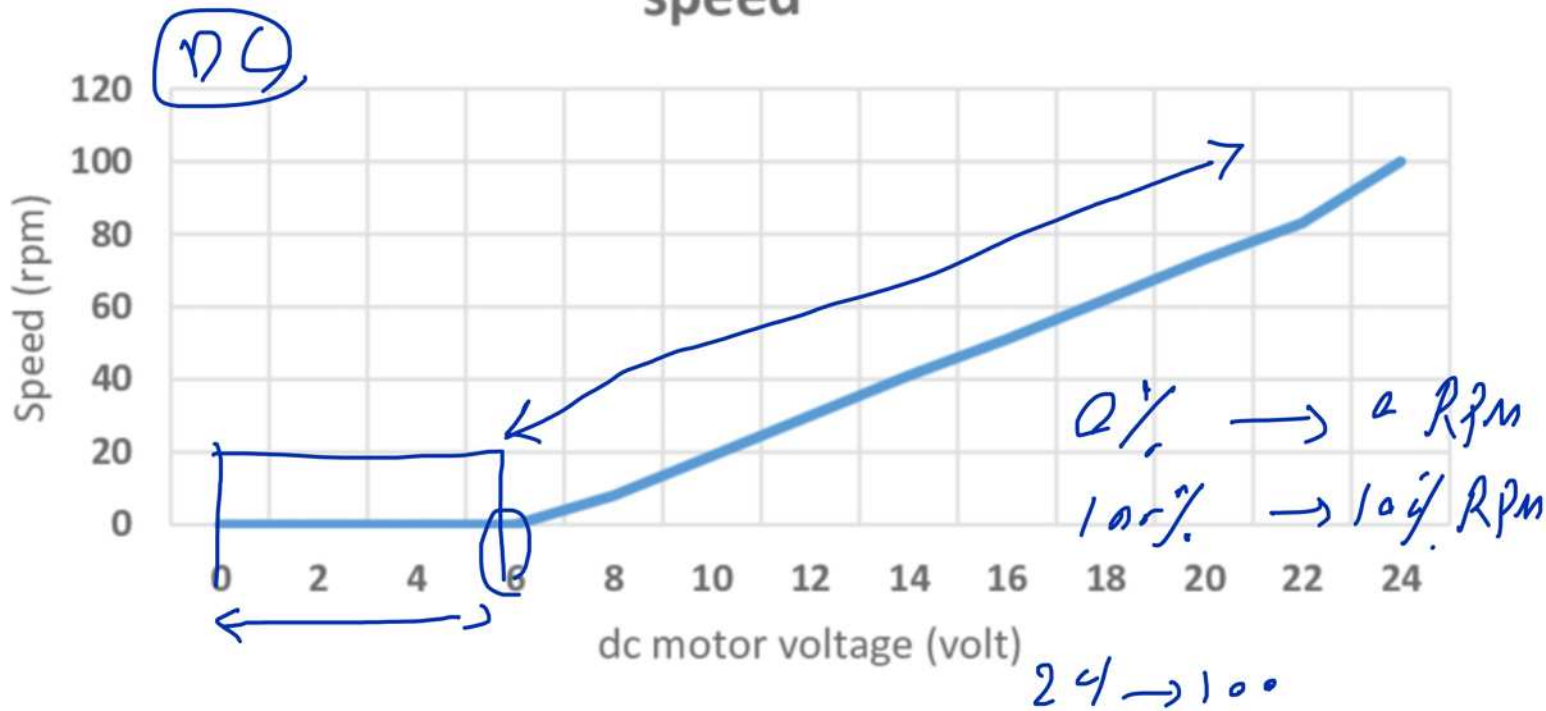
Symbol	Parameter	Value	Unit
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V_{SS}	Logic Supply Voltage	7	V
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V_{sens}	Sensing Voltage	-1 to 2.3	V
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T_{op}	Junction Operating Temperature	-25 to 130	$^\circ C$
T_{stg}, T_j	Storage and Junction Temperature	-40 to 150	$^\circ C$



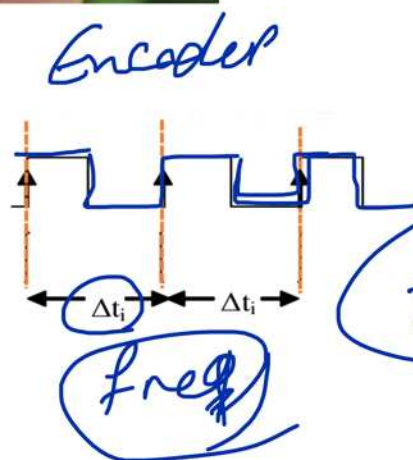
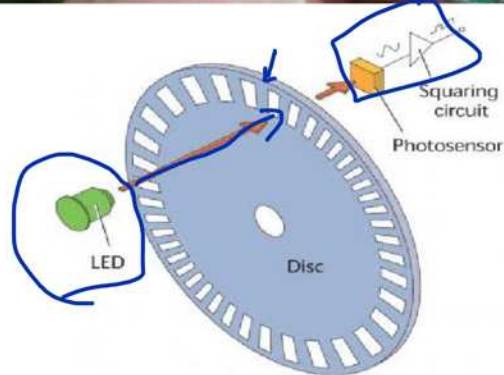
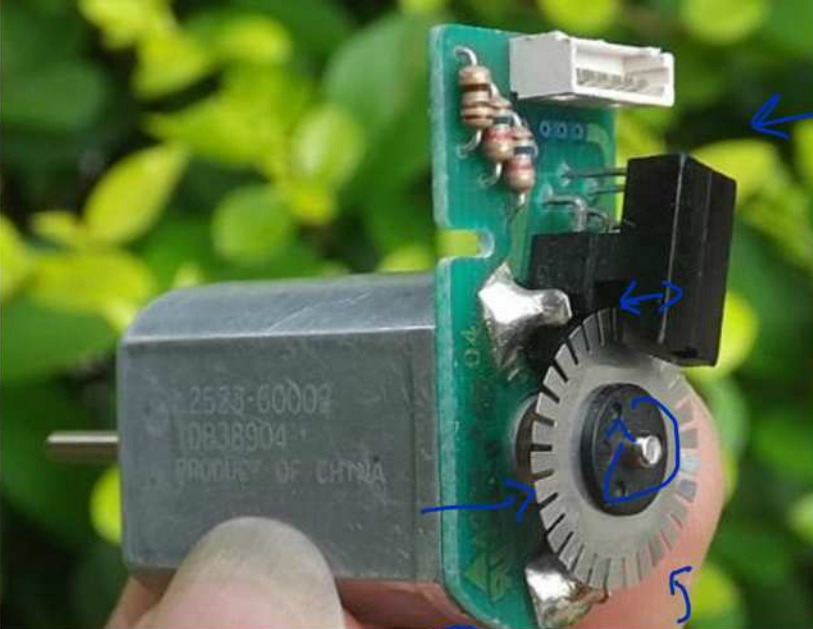
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Supply Voltage	36	V
V_{SS}	Logic Supply voltage	36	V
V_i	Input voltage	7	V
V_{en}	Enable voltage	7	V
I_o	Peak output current (100 μ s non repetitive)	1.2	A
P_{tot}	Total power dissipation at $T_{ground-pins} = 80^{\circ}C$	5	W
T_{stg}, T_j	Storage and junction temperature	-40 to 150	$^{\circ}C$

Graph of DC motor voltage to the motor speed



Power flow diagram of a DC motor

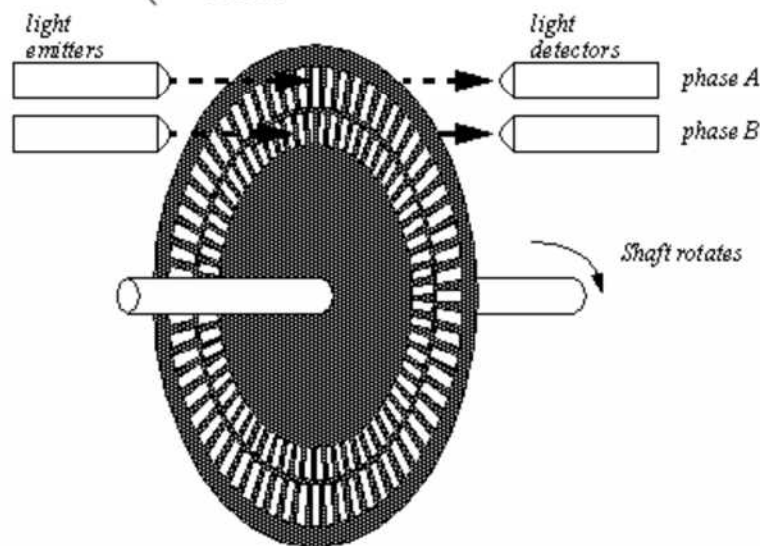
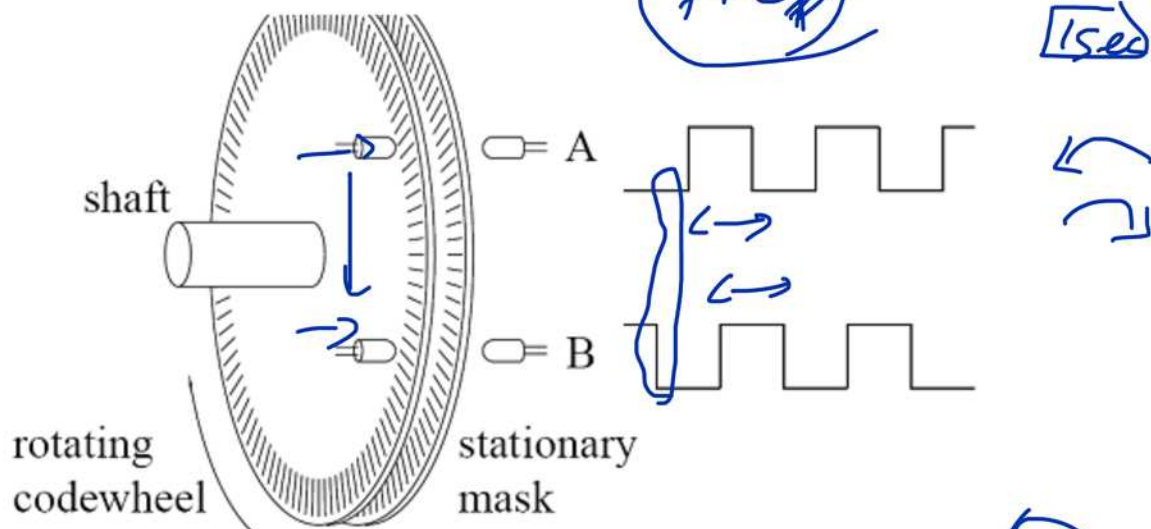


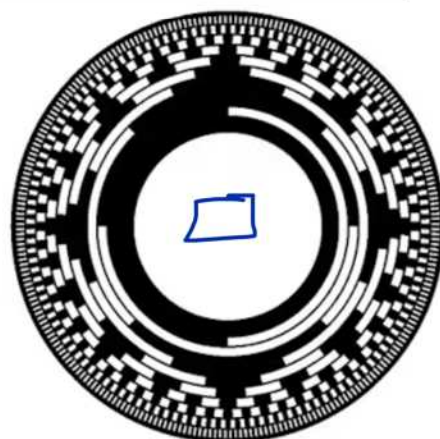
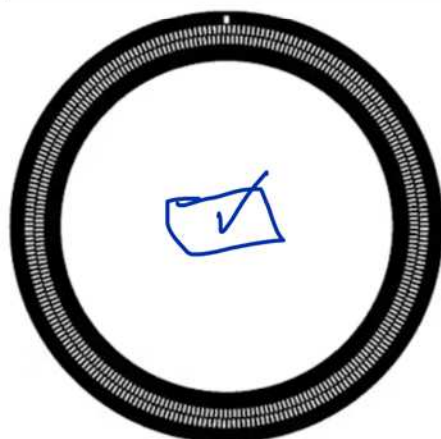
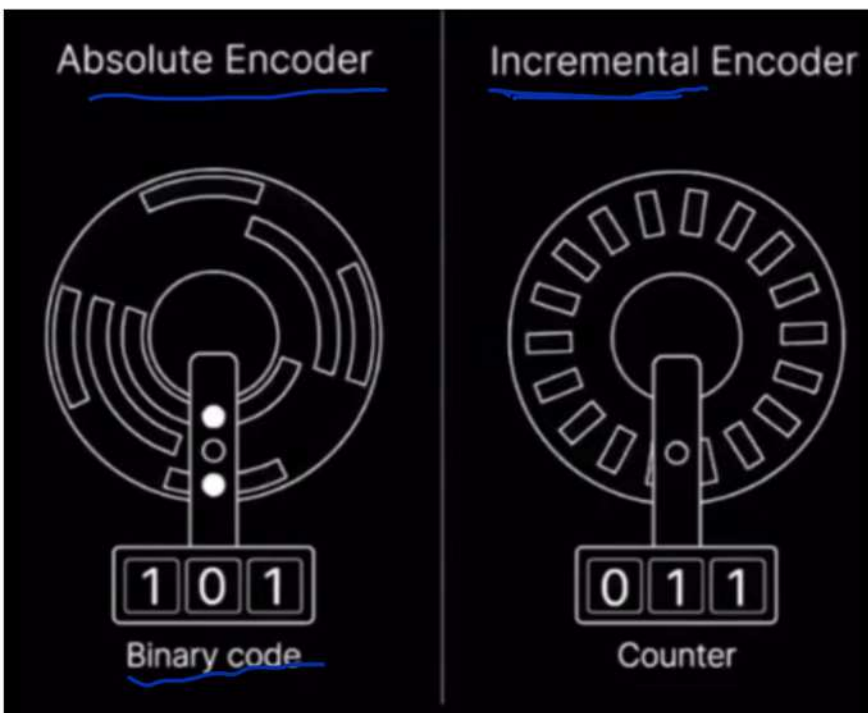
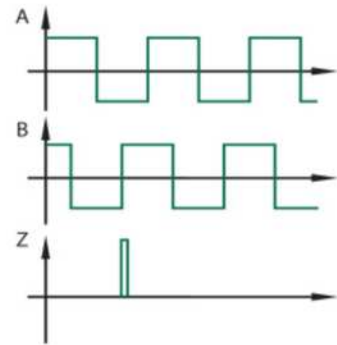
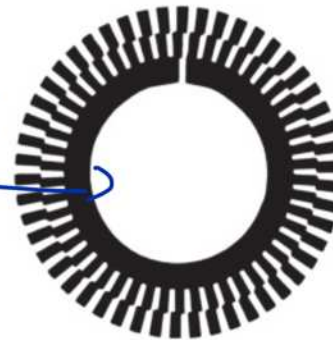
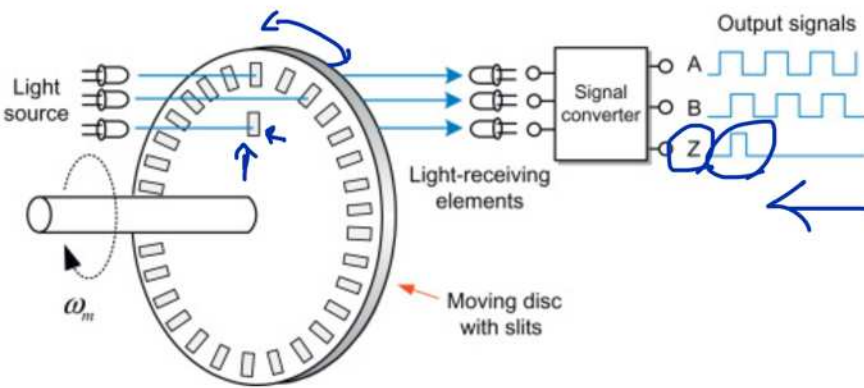
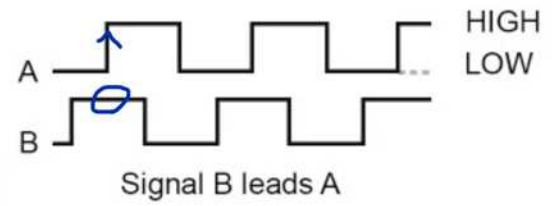
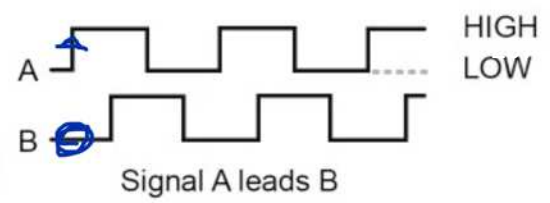
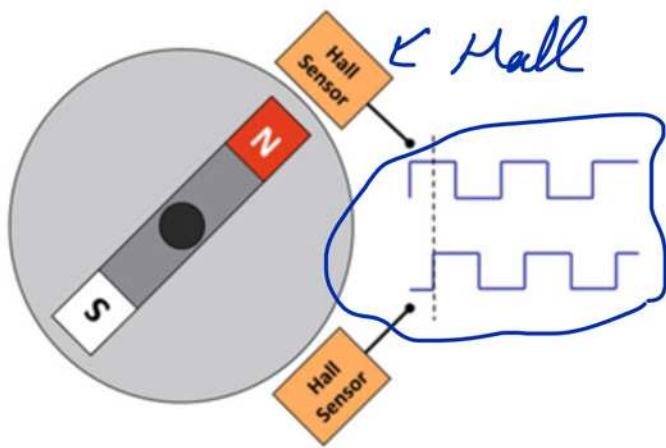
PPR: pulse per revolution

↑
Revolution
↓

$$\frac{1}{\Delta t_i} = f_{freq}$$

1 sec





1 Incremental

2 Absolute



Features:

Name: JGA25-13CPR DC geared motor

Voltage: 6-12V

Nominal Voltage: 12V

Pulse: 26 / ring

Speed: 240rpm(6V), 352rpm(12V)

Shaft diameter: 4mm

Length: 12mm

Encoder motor end 11 signals

Terminal connection length 20cm

Hal

Load Torque:

Torque: 0.85 - 1.2kg.cm

Stall Torque: 5.6 - 8 kg.cm

Connection:

red: motor positive

Black: negative Motor

Green: Encoder negative

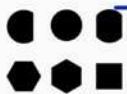
Blue: encoder positive

white and yellow: motor A-phase and B-phases

1: 3 4

Reduction ratio	Voltage DC	No-load speed	No-load current	Load speed	Load current	Load torque	rated power	Stall Torque	Stall Current
1: XX	Volt.V	rpm / m	ma	rpm / m	ma	kg.cm	W	kg.cm	ma
1:34	12V	126	46	100	250	0.85	1.25	4.2	1000

Metal shaft shape selection



Gear box series



Motor

brush
brushless
stepper



can be choose bevel wheel / spur gear

Encoder

Shell

Metal shell
Plastic shell

Sun Gear

Plastic Gear:
powder metallurgy
Metal processing

$$PPR = 26$$

$$GR = 34$$

$$RPM = \frac{PC \times 60}{PPR \times GR}$$

$$RPM = PC \times \frac{60}{26 \times 34}$$

$$RPM = PC \times 0.0679$$

$$RPM = PC \times \left(\frac{60}{26 \times 34} \right)$$

$$RPM = f_{ref} \times 0.136$$

