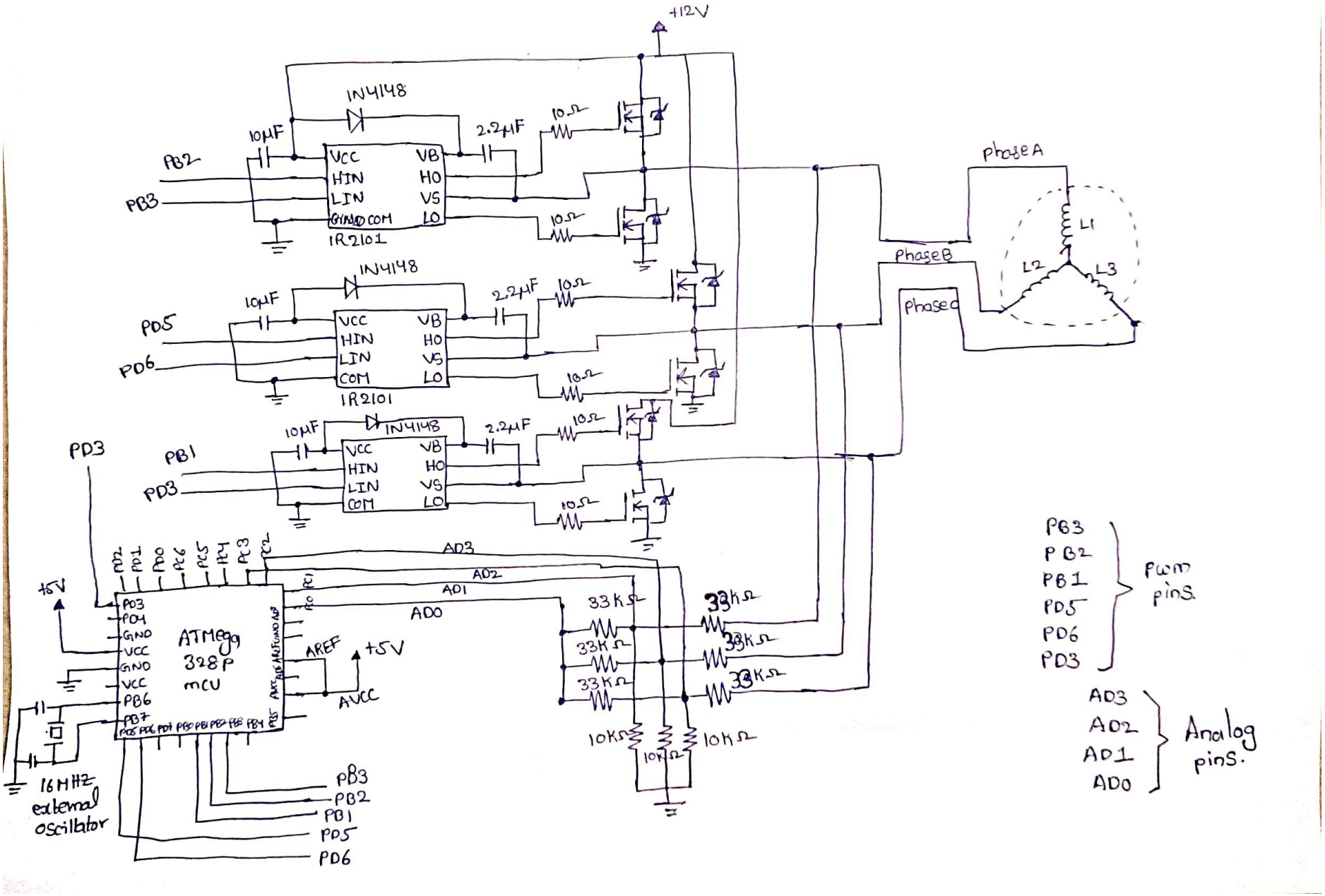
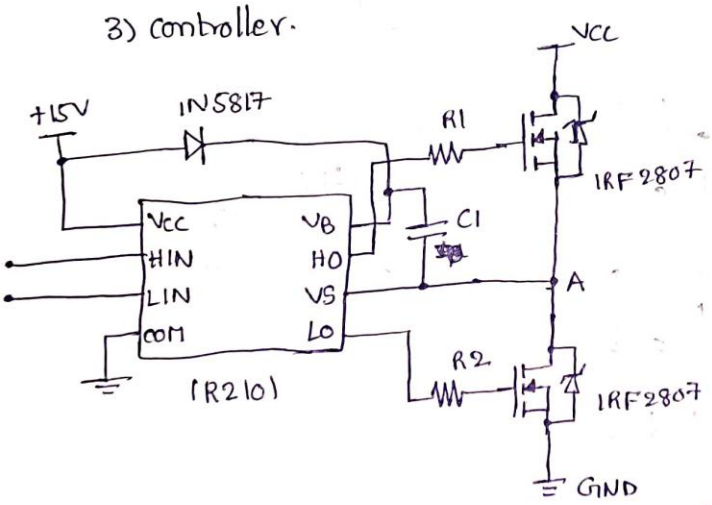

+12V
IN4148
10µF
2.2µF
10Ω
PB2
PB3
VCC
HIN
LIN
GND COM
VB
HO
VS
LO
IR2101
PD5
PD6
PD3
PB1
PhaseA
PhaseB
Phasec
L1
L2
L3
AD3
AD2
AD1
AD0
+5V
AREF
AVCC
ATMega
328P
mcu
16MHz
external
oscillator
33KΩ
10KΩ
PB3
PB2
PB1
PD5
PD6
PB3
PB2
PB1
PD5
PD6
Pwm
pins
AD3
AD2
AD1
AD0
Analog
pins.

BLDC
Motor driver circuit

* BLDC motor have three-phase windings
* A driver circuit energizes the correct windings at the right time to maintain rotation.

circuit stages:-

1) power stage
2) Gate Driver
3) controller.



Half bridge with N-channel mosfet

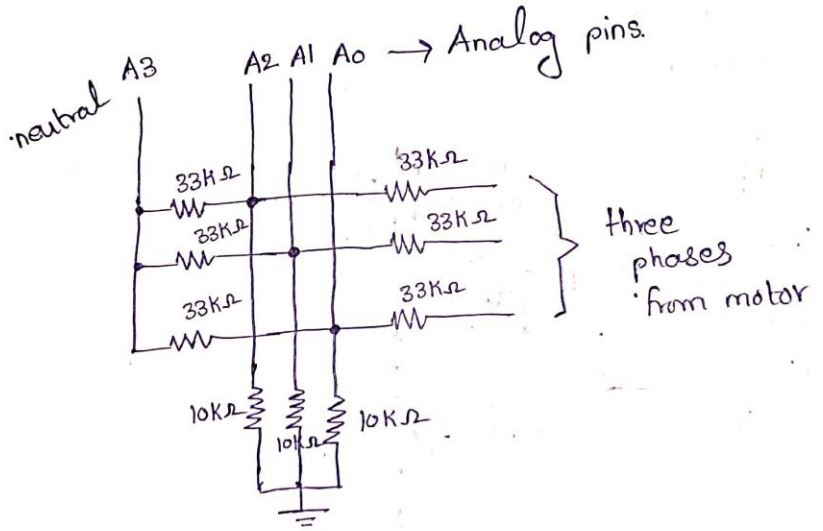
* The IR2101 provides the gate signals to turn the MOSFETs 'on' and 'off'
* IR2101 uses a bootstrap capacitor + diode to generate gate voltage higher than the supply.
  This allows the high-side MOSFETs to switch properly.

* LO pin of IR2101 directly drives the low-side MOSFETS

MCU

* Arduino generates 6 PWM signal
  (HIN + LIN for each IR2101)

pins (11, 10, 9, 6, 5, 3) → generates pwm signals.



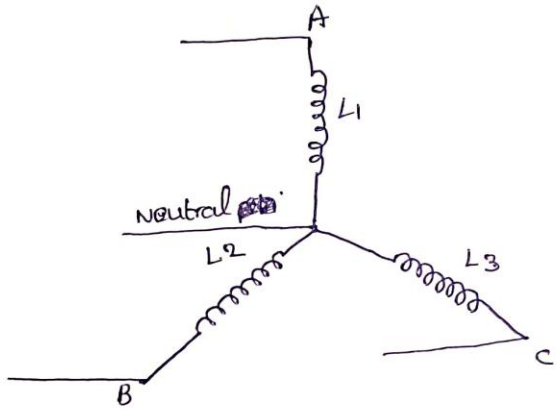
$$V_{out} = V_{in} \times \frac{10K\Omega}{30K\Omega + 10K\Omega} = V_{in} \times \frac{10}{43}$$

$V_{out} \approx 0.23 \times V_{in}$

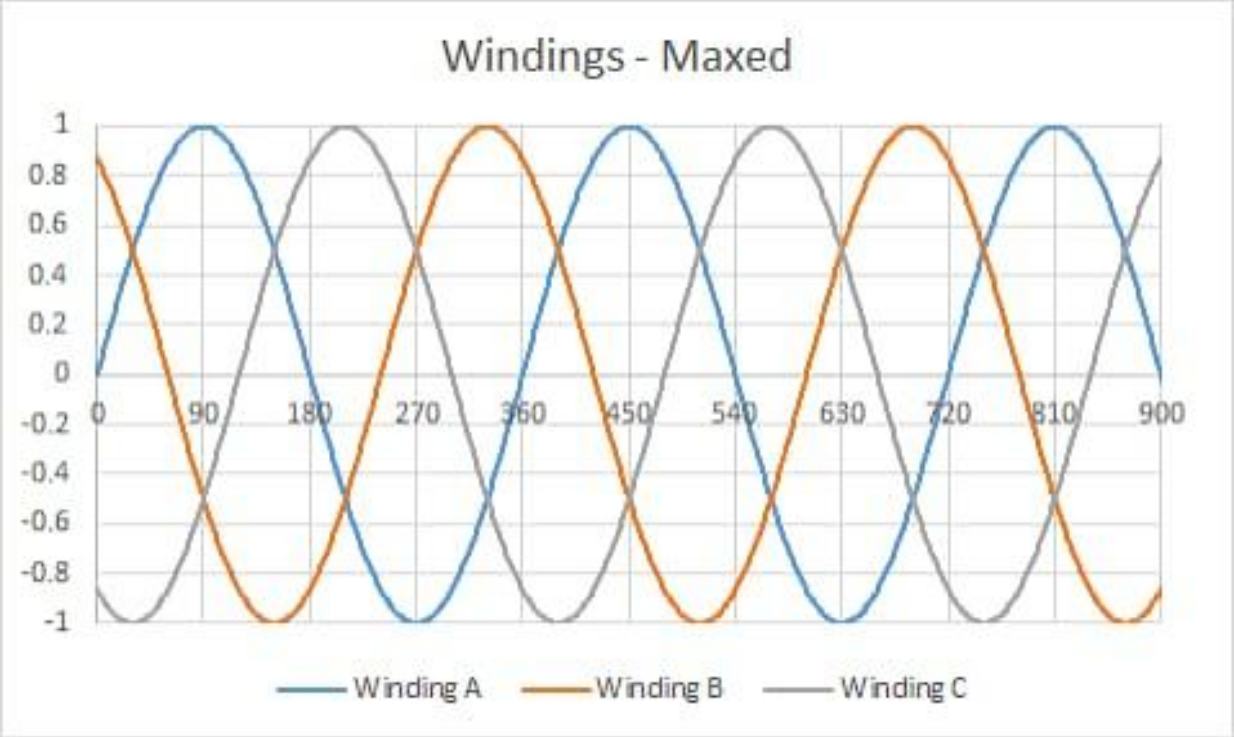
* if motor powered by 12V
  Arduino sees ≈ 2.8V
  not safe for 24V and 48V, we have to choose more R value.

* when a phase is floating, Arduino reads its scaled back-EMF waveform
* Arduino compares this waveform with half of the DC bus voltage (Neutral).
* when the back-emf crosses this midpoint (zero crossing detection), it means the rotor has reached the high spot

BLDC



Step	1	2	3	4	5	6
High	A	B	B	C	C	A
Low	C	C	A	A	B	B


Windings - Maxed
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
90
180
270
360
450
540
630
720
810
900
Winding A
Winding B
Winding C