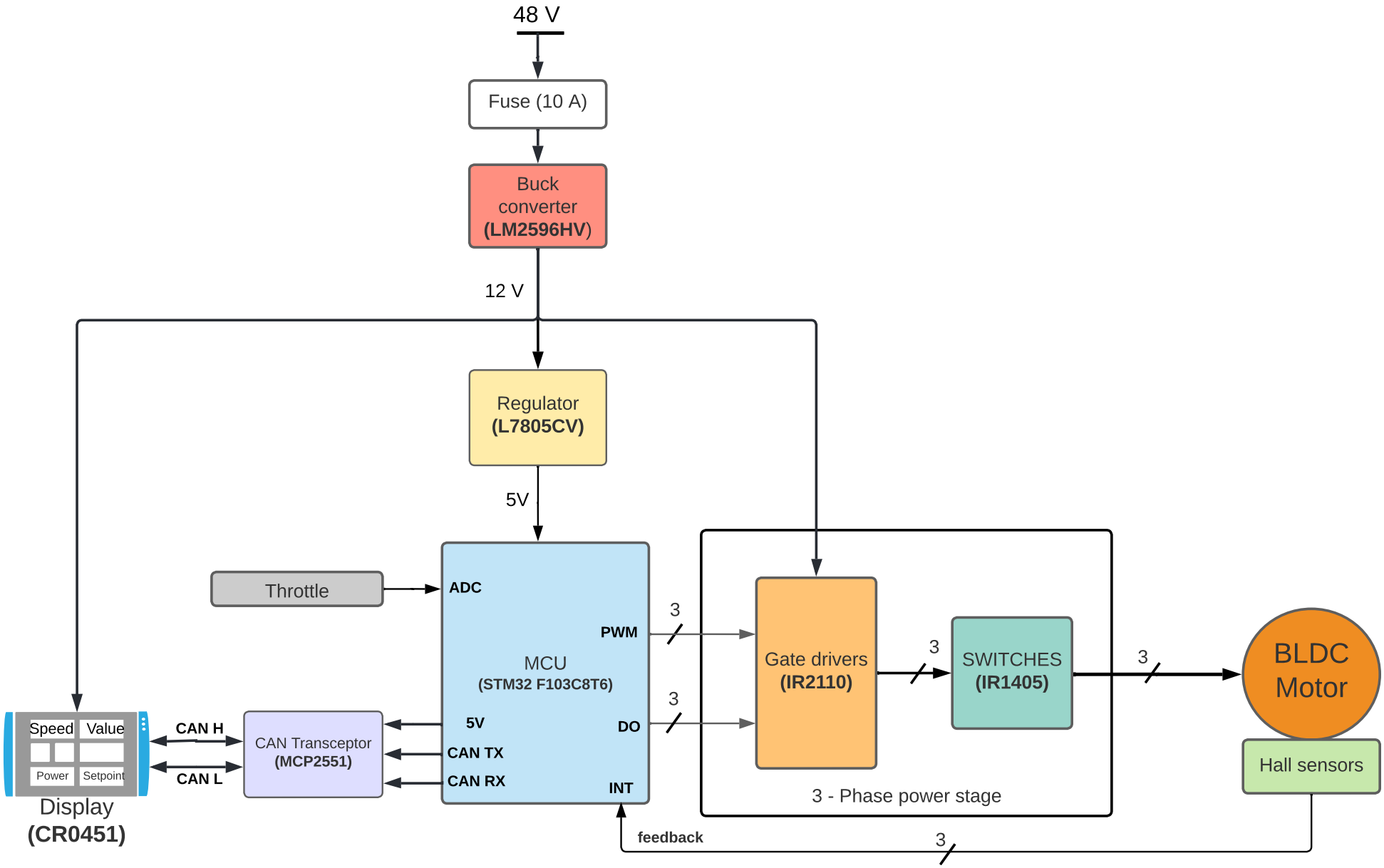
Motor Controller Documentation

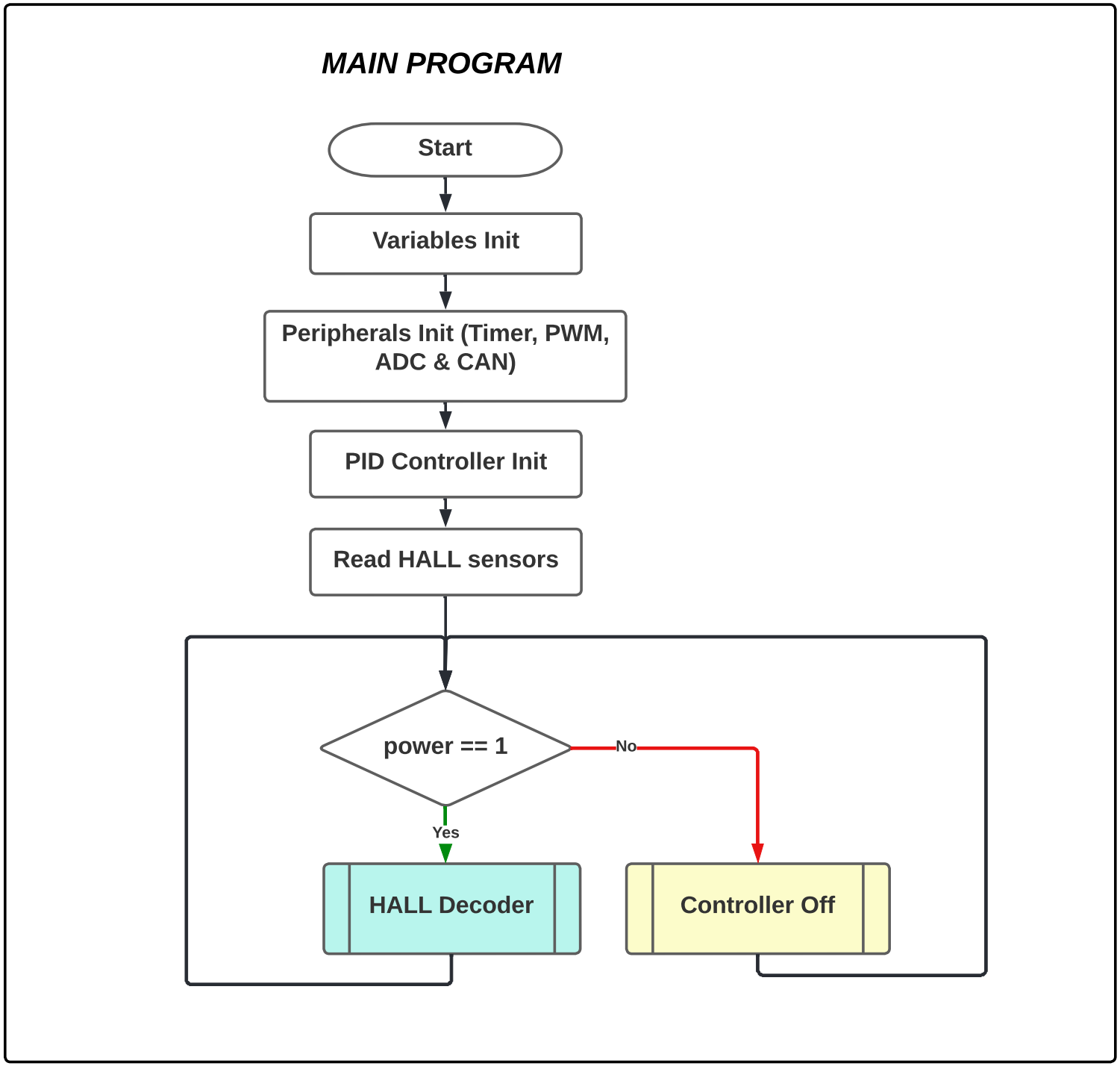
2021/2022

Team ID: PE0002001

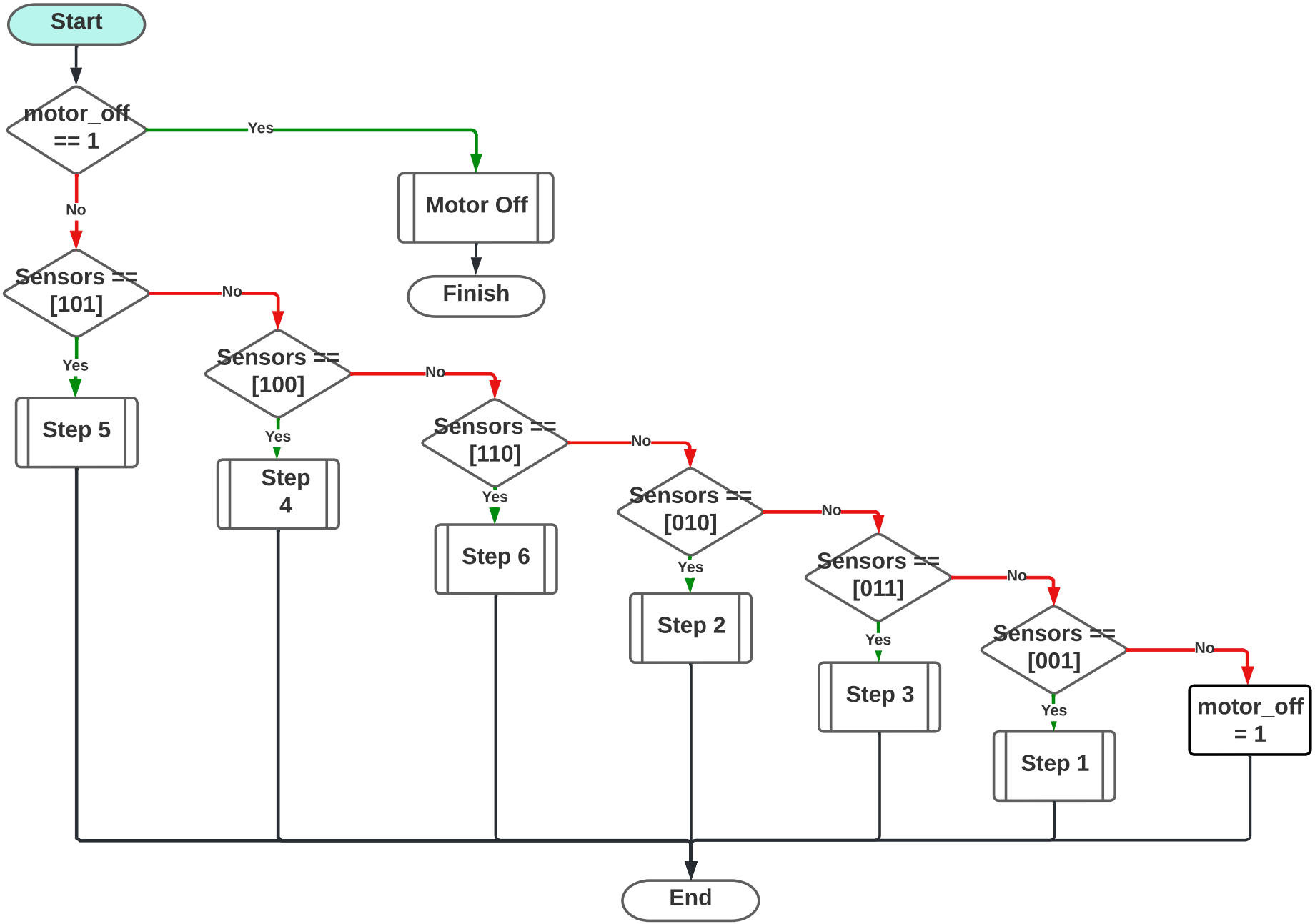
Electronic Speed Controller

(Hardware)

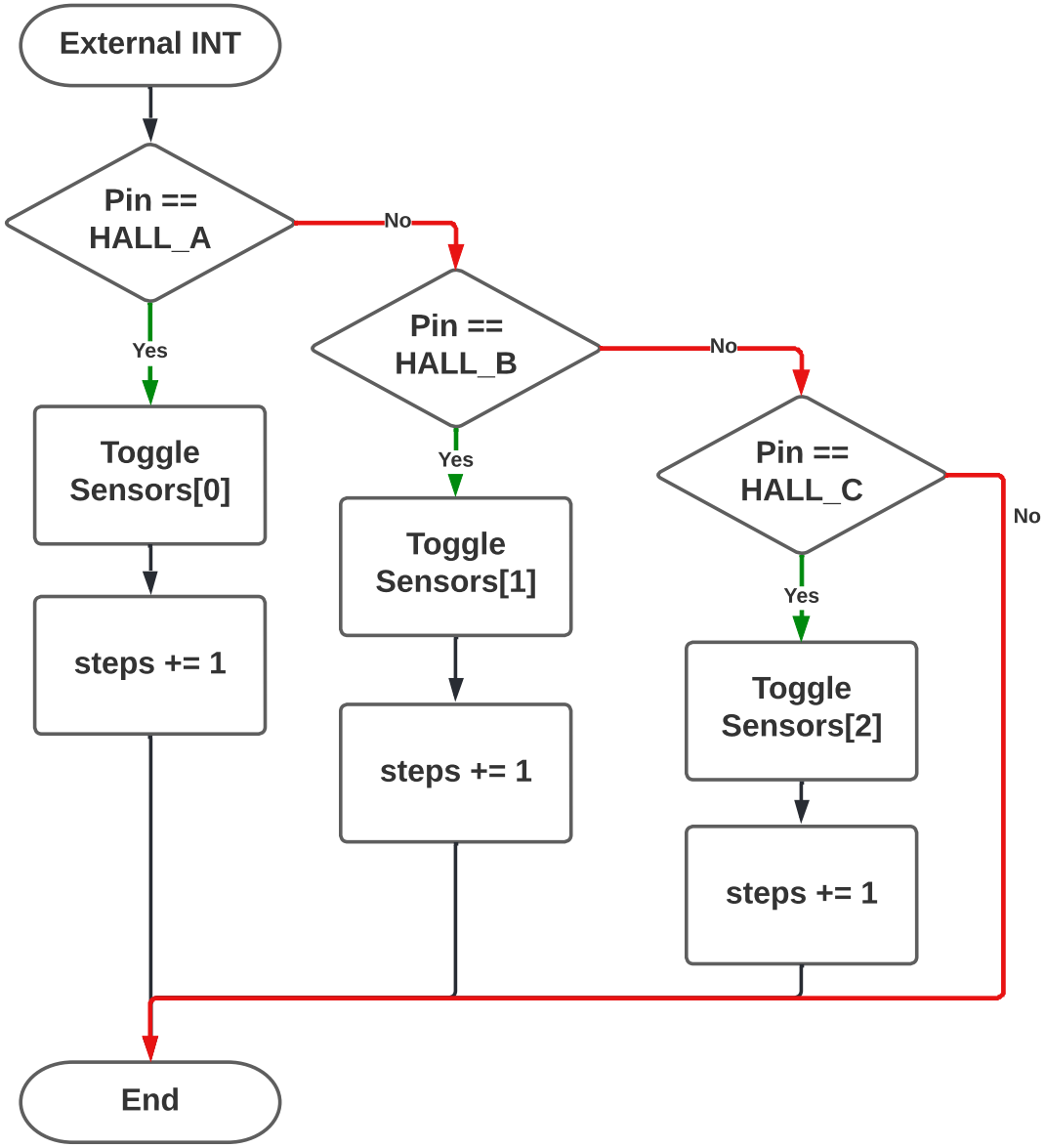


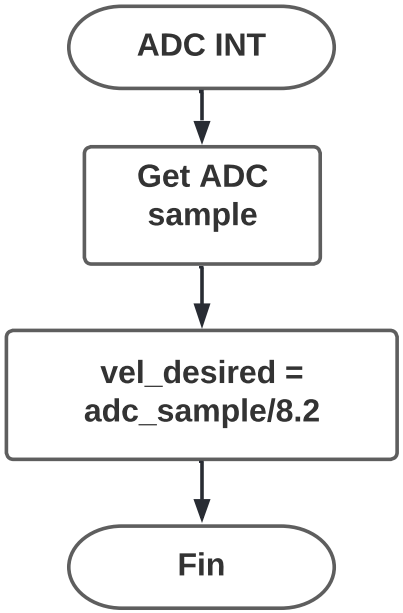

MAIN PROGRAM
Start
Variables Init
Peripherals Init (Timer, PWM, ADC & CAN)
PID Controller Init
Read HALL sensors
power == 1
No
Yes
HALL Decoder
Controller Off

HALL Decoder Subroutine

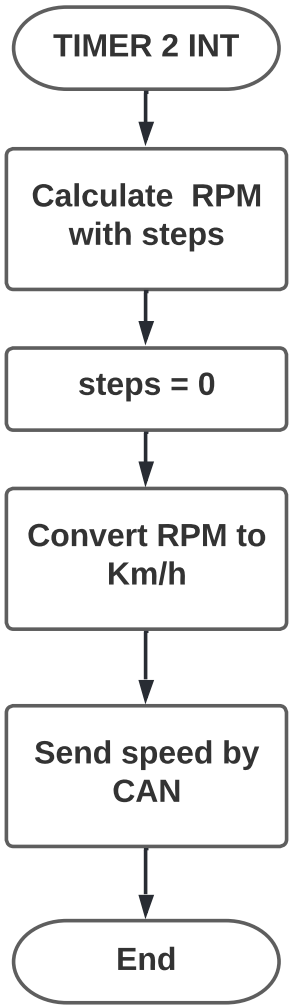


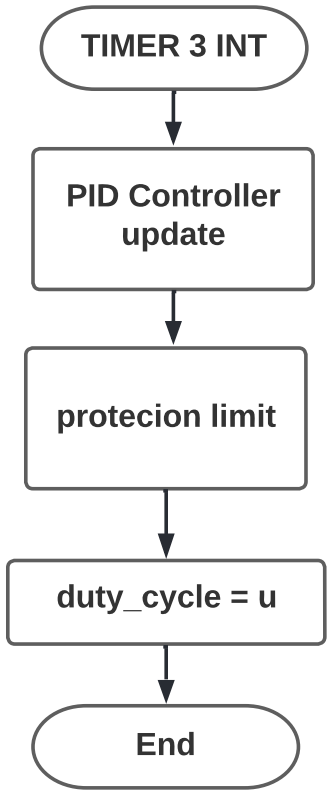
Interrupt routines

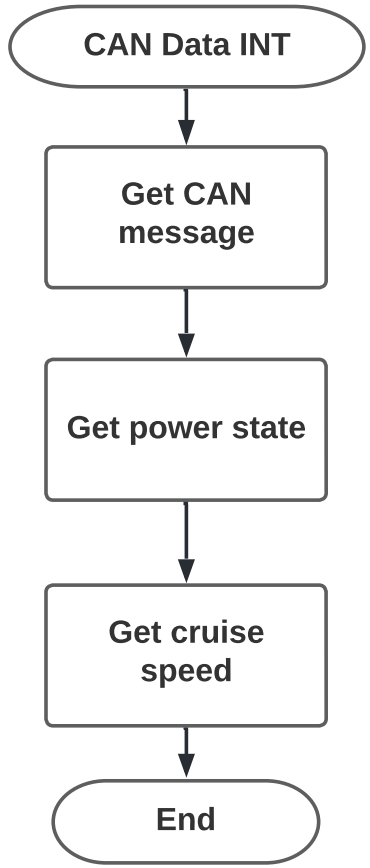


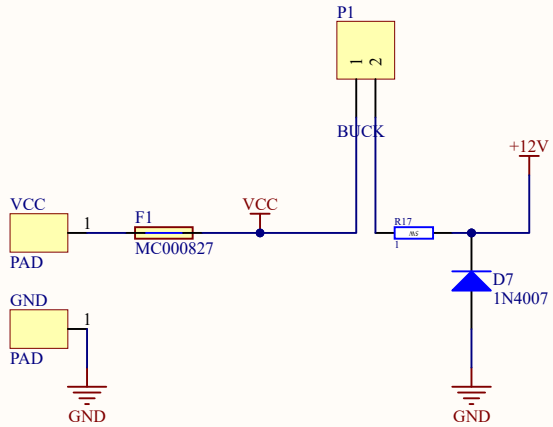


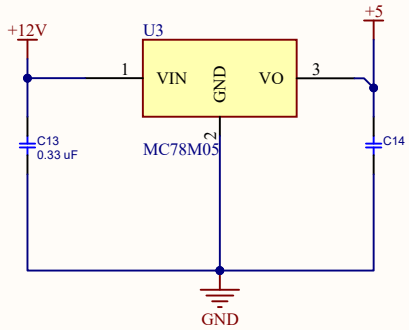
* **8.2** is the factor to convert 12 bits adc to 0-500 rpm

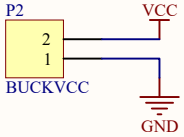

TIMER 2 INT
Calculate RPM with steps
steps = 0
Convert RPM to Km/h
Send speed by CAN
End

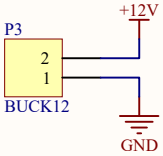

TIMER 3 INT
PID Controller update
protecion limit
duty_cycle = u
End


CAN Data INT
Get CAN message
Get power state
Get cruise speed
End









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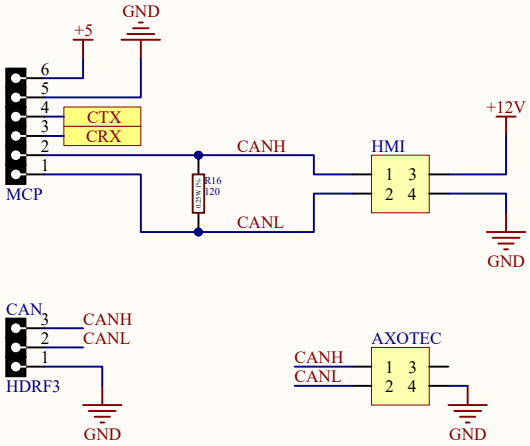

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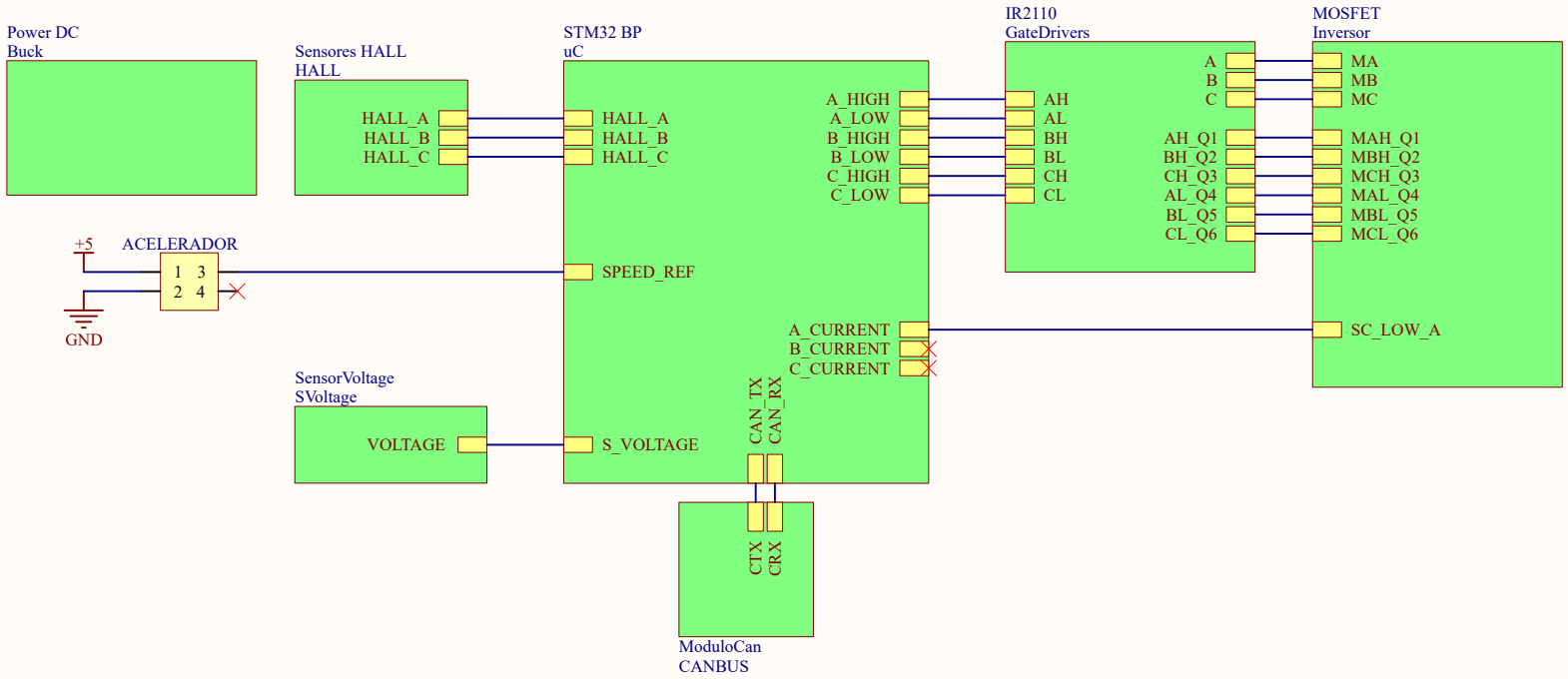

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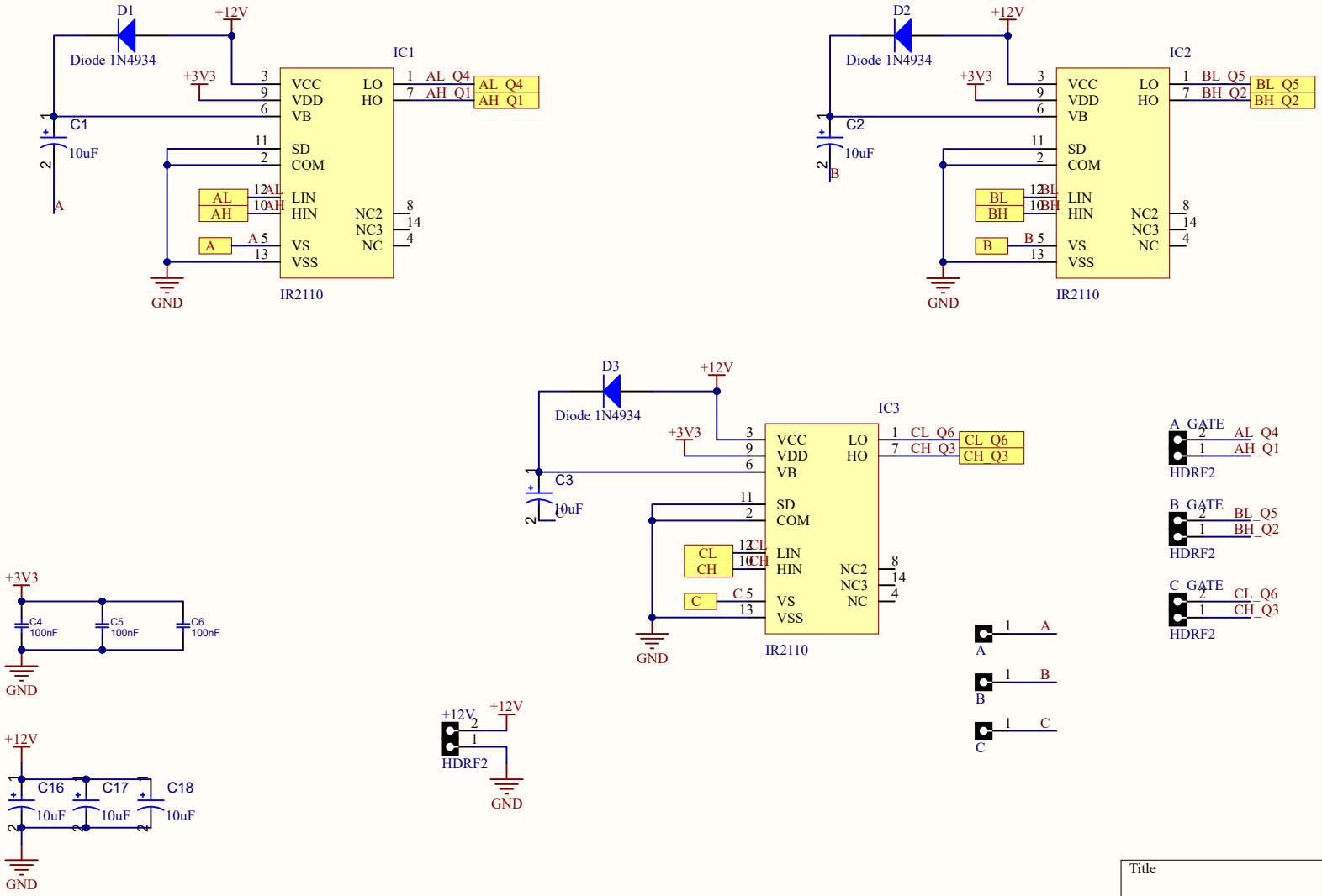
D1
Diode 1N4934
+12V
IC1
+3V3
VCC
VDD
VB
SD
COM
LIN
HIN
VS
VSS
LO
HO
NC2
NC3
NC
AL_Q4
AH_Q1
C1
10uF
AL
AH
A
GND
IR2110
D2
Diode 1N4934
+12V
IC2
+3V3
BL_Q5
BH_Q2
C2
10uF
BL
BH
B
GND
IR2110
D3
Diode 1N4934
+12V
IC3
+3V3
CL_Q6
CH_Q3
C3
10uF
CL
CH
C
GND
IR2110
A_GATE
B_GATE
C_GATE
HDRF2
A
B
C
+3V3
C4
100nF
C5
100nF
C6
100nF
GND
+12V
C16
C17
C18
10uF
10uF
10uF
GND
+12V
+12V
HDRF2
GND
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Revision
Date:
8/19/2022
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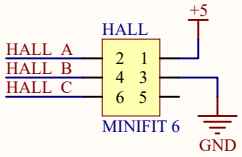

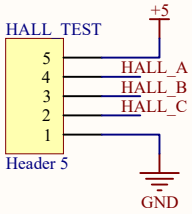

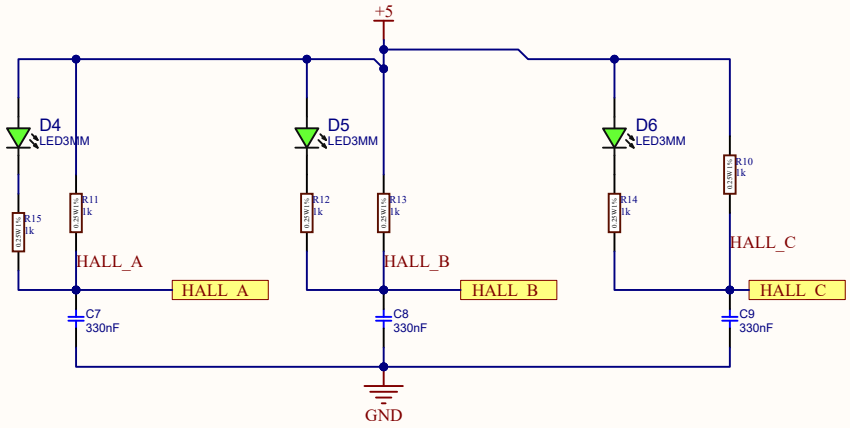

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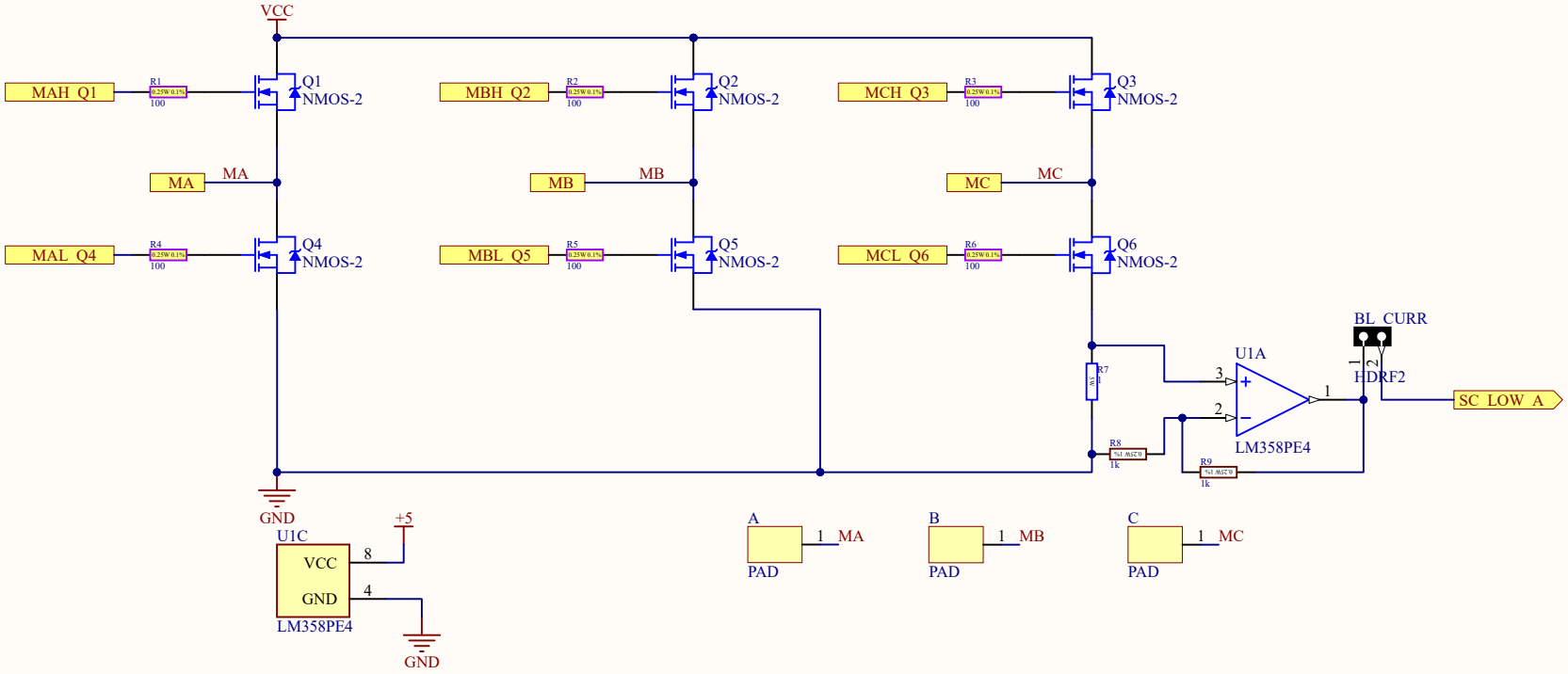
Ciruito Inversor de Potencia



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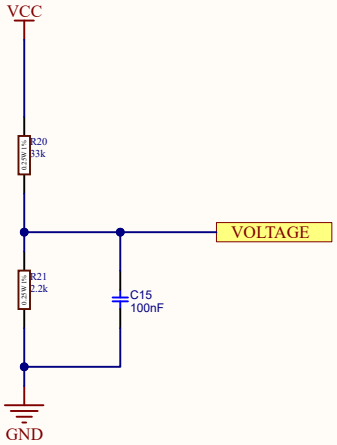

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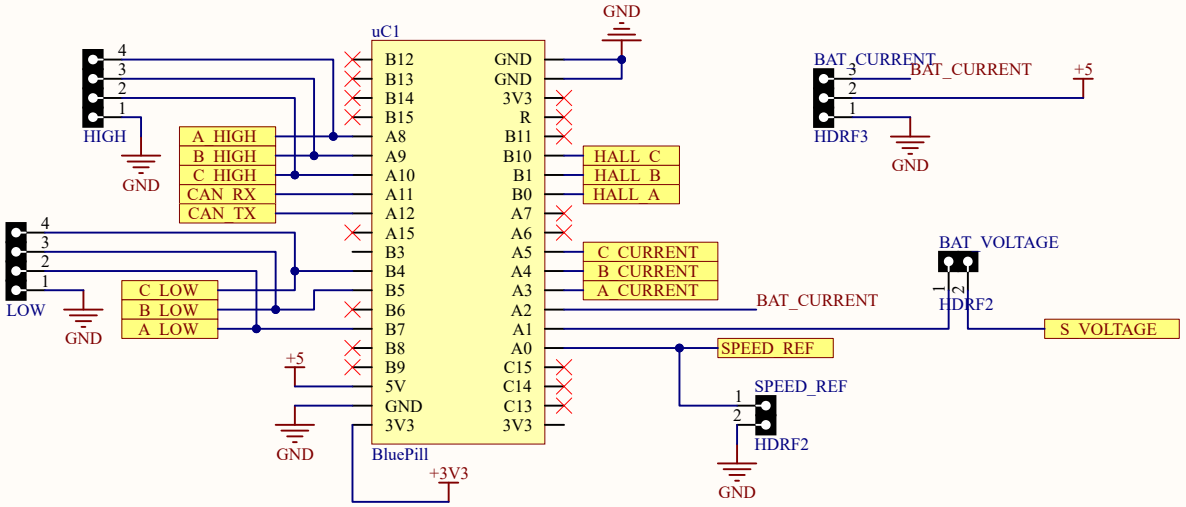

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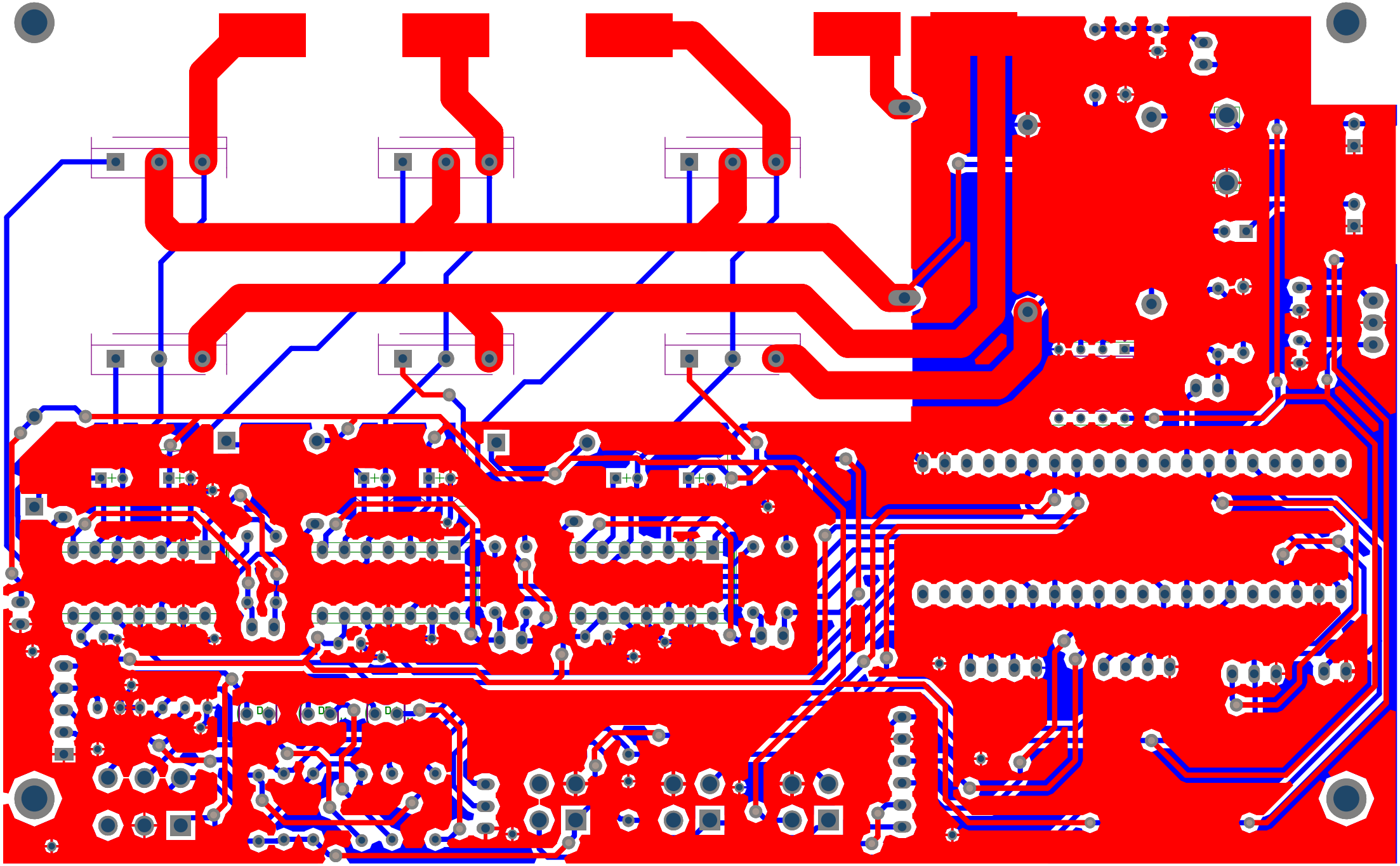
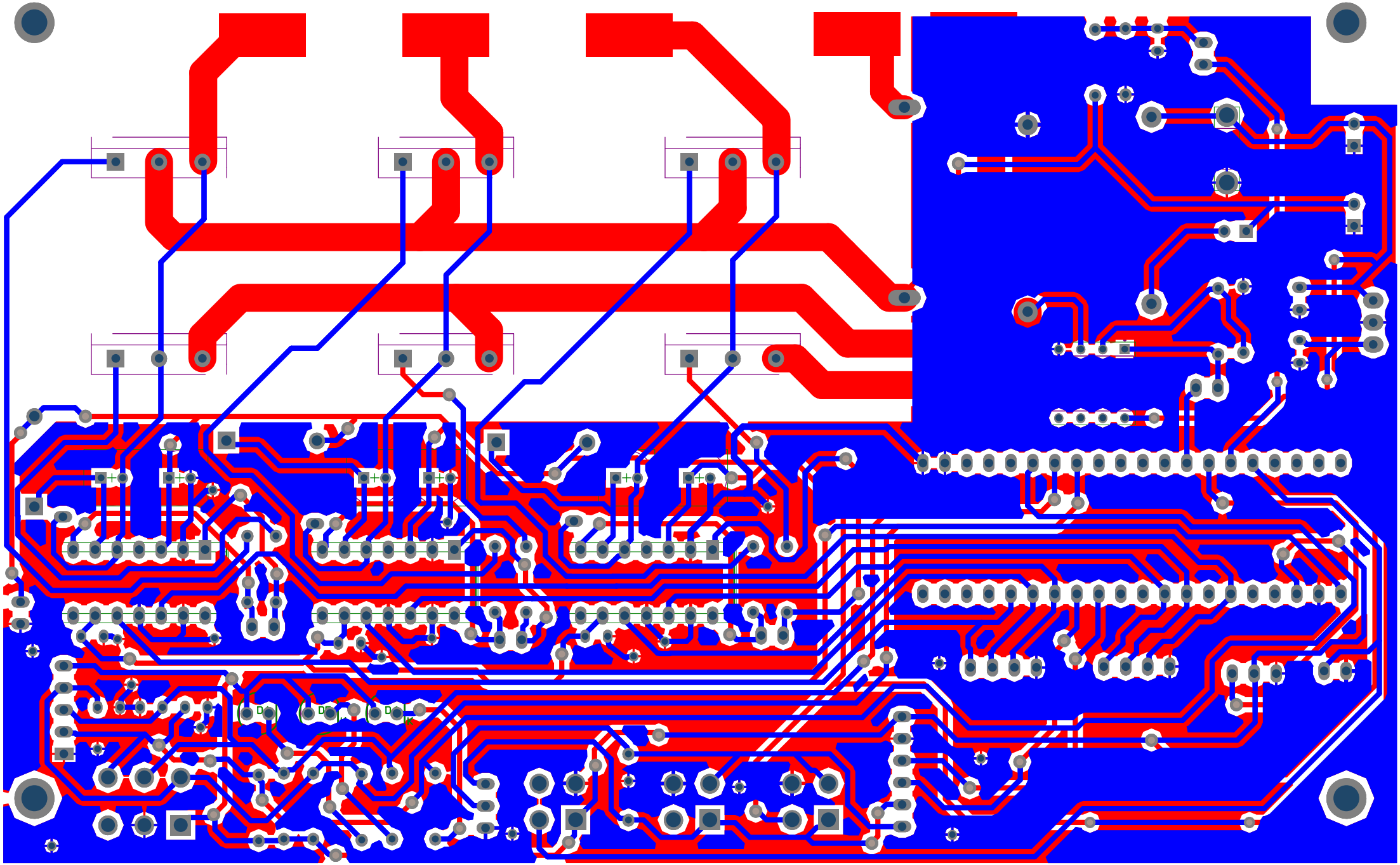
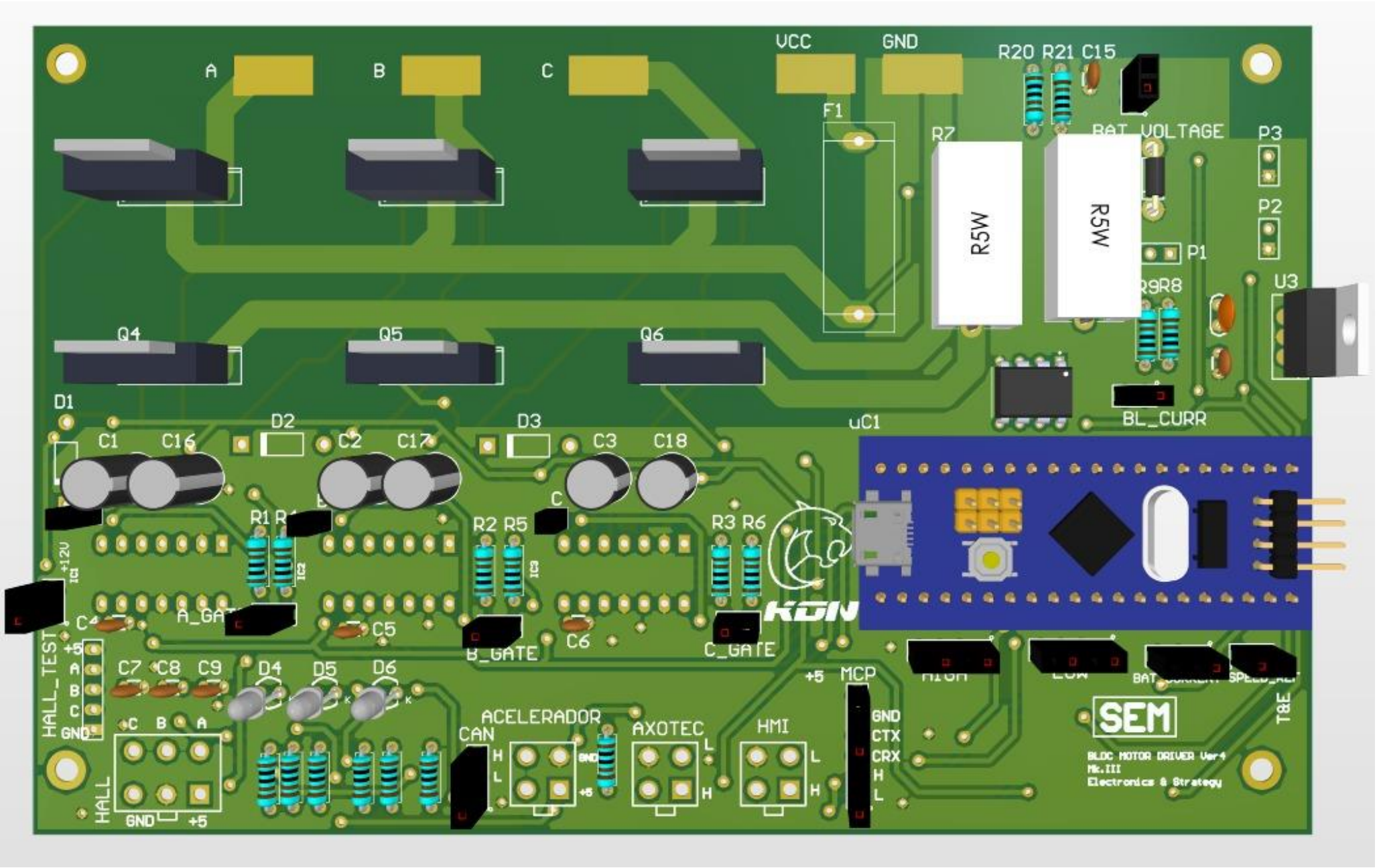
10uF	C1, C2, C3, C16, C17, C18	6
100uF 100V	C10	1
470uF 50V	C11,C12	2
0.33uF	C13	1
0.1uF	C14	1
100nF	C4, C5, C6, C15	4
330nF	C7, C8, C9	3
4148 diodo schottky	D1, D2, D3	3
LEDS	D4, D5, D6, D8(led buck)	4
MBR360G	D7	1
IR2110	IC1, IC2, IC3	3
220uH	L1	1
IR1405	Q1, Q2, Q3, Q4, Q5, Q6	6
1k	R1, R2, R3, R4, R5, R6	6
0.5 5w	R7	1
1k	R8, R9, R10, R11, R12, R13, R14, R15, R19	9
120	R16	1
10k	R17	1
1.1k	R18	1
33k	R20	1
2.2k	R21	1
LM7805	U3	1
BluePill (STM32F103C8T6)	uC1	1
Fuse holder		1
Fuse (10 A)		1
Female contacts		2
Male contacts		2
M12 connector		2




D
D
D
K


A
B
C
VCC
GND
F1
R20 R21 C15
R7
R5W
R5W
BAT_VOLTAGE
P3
P2
P1
R9R8
U3
Q4
Q5
Q6
D1
D2
D3
C1
C16
C2
C17
C3
C18
C
uC1
BL_CURR
R1 R4
R2 R5
R3 R6
+12V
IC1
IC2
IC3
C4
C5
C6
A_GATE
B_GATE
C_GATE
KDN
HALL_TEST
+5
A
B
C
GND
C7
C8
C9
D4
D5
D6
+C
B
A
HALL
GND
+5
ACELERADOR
CAN
H
L
GND
+5
AXOTEC
L
H
HMI
L
H
+5
MCP
GND
CTX
CRX
H
L
HIGH
LOW
BAT
T&E
SEM
BLDC MOTOR DRIVER Ver4
Mr.III
Electronics & Strategy

PD -93991A

International
IOR Rectifier

AUTOMOTIVE MOSFET

IRF1405

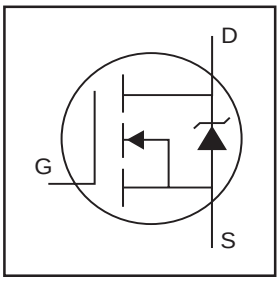
Typical Applications

- Electric Power Steering (EPS)
- Anti-lock Braking System (ABS)
- Wiper Control
- Climate Control
- Power Door

Benefits

- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax

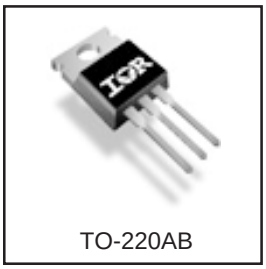
HEXFET® Power MOSFET



V_{DSS} = 55V

$R_{DS(on)}$ = 5.3mΩ

I_D = 169A⑥



TO-220AB

Description

Specifically designed for Automotive applications, this Stripe Planar design of HEXFET® Power MOSFETs utilizes the lastest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this HEXFET power MOSFET are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These benefits combine to make this design an extremely efficient and reliable device for use in Automotive applications and a wide variety of other applications.

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	169⑥	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	118⑥	
I_{DM}	Pulsed Drain Current ①	680	
P_D @T_C = 25°C	Power Dissipation	330	W
	Linear Derating Factor	2.2	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②	560	mJ
I_{AR}	Avalanche Current	See Fig.12a, 12b, 15, 16	A
E_{AR}	Repetitive Avalanche Energy⑦		mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
T_J	Operating Junction and	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.45	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	

3/25/01

Data Sheet No. PD60147 rev.V

International
IOR Rectifier

IR2110(S)PbF/IR2113(S)PbF

HIGH AND LOW SIDE DRIVER

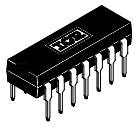
Features

- Floating channel designed for bootstrap operation
  Fully operational to +500V or +600V
  Tolerant to negative transient voltage
  dV/dt immune
- Gate drive supply range from 10 to 20V
- Undervoltage lockout for both channels
- 3.3V logic compatible
  Separate logic supply range from 3.3V to 20V
  Logic and power ground ±5V offset
- CMOS Schmitt-triggered inputs with pull-down
- Cycle by cycle edge-triggered shutdown logic
- Matched propagation delay for both channels
- Outputs in phase with inputs

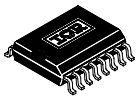
Product Summary

V_{OFFSET} (IR2110)	500V max.
(IR2113)	600V max.
I_O+/-	2A / 2A
V_{OUT}	10 - 20V
$t_{on/off}$ (typ.)	120 & 94 ns
Delay Matching (IR2110)	10 ns max.
(IR2113)	20ns max.

Packages



14-Lead PDIP
IR2110/IR2113

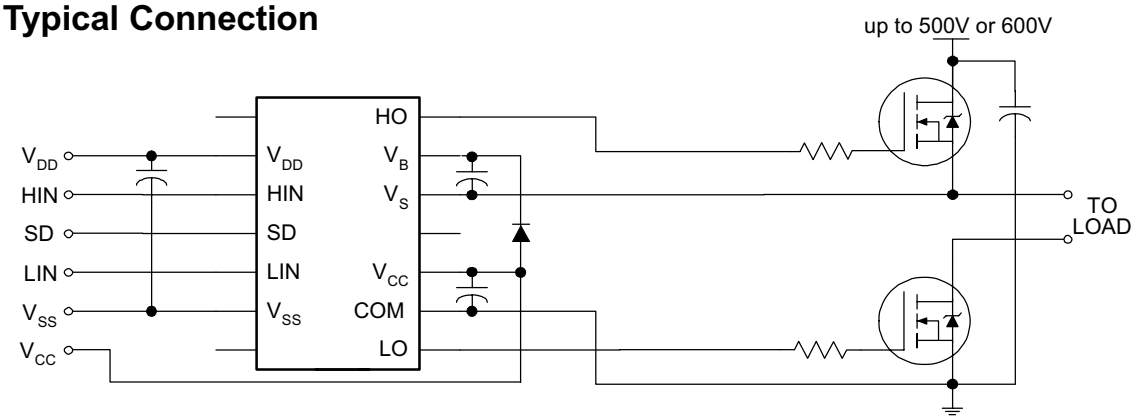


16-Lead SOIC
IR2110S/IR2113S

Description

The IR2110/IR2113 are high voltage, high speed power MOSFET and IGBT drivers with independent high and low side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. Logic inputs are compatible with standard CMOS or LSTTL output, down to 3.3V logic. The output drivers feature a high pulse current buffer stage designed for minimum driver cross-conduction. Propagation delays are matched to simplify use in high frequency applications. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high side configuration which operates up to 500 or 600 volts.

Typical Connection



(Refer to Lead Assignments for correct pin configuration). This/These diagram(s) show electrical connections only. Please refer to our Application Notes and DesignTips for proper circuit board layout.

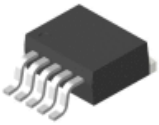
60V, 3A, 150kHz, Step-down Switching Regulator LM2596HV

FEATURES

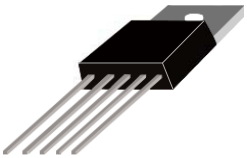
- 3.3V, 5V, 12V and Adjustable output versions
- Adjustable version output voltage range, 1.23V to 57V
- ±4% max over line and load condition
- Available in TO-220, TO-263 and SOP-8PP
- Guaranteed 3A output load current
- Input voltage range up to 60V
- Requires only 4 external components
- Excellent line and load regulation specifications
- 150kHz fixed frequency internal oscillator
- Low power standby mode, I_{STB} typically 30uA
- High efficiency
- Thermal shutdown and current limit protection
- Output short protection by reduction of frequency by 3 times

SOP-8PP PKG

TO-263 PKG



TO-220 PKG



ORDERING INFORMATION

Device	Package
LM2596HVGDP-ADJ	SOP-8PP
LM2596HVGDP-X.X	
LM2596HVGR-ADJ	TO-263 5L
LM2596HVGR-X.X	
LM2596HVGT-ADJ	TO-220 5L
LM2596HVGT-X.X	

X.X = Output Voltage = 3.3, 5.0, 12

APPLICATION

- Simple high-efficiency step-down (buck) regulator
- Efficient pre-regulator for linear regulators
- On-card switching regulators

DESCRIPTION

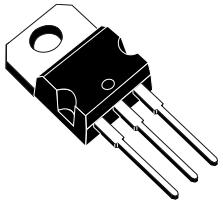
The LM2596HV series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving a 3A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3V, 5V, 12V, and an adjustable output version.
Available in a standard 5-lead TO-220 package and a 5-lead TO-263 surface mount package.
External shutdown is included, featuring typically 30 μA standby current. The output switch includes cycle-by-cycle current limiting, as well as thermal shutdown, and protection from output short for full protection under fault conditions.

Absolute Maximum Ratings (Note 1)

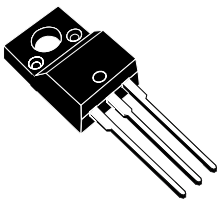
CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Supply Voltage	V_{IN}	-	63	V
ON/OFF Pin Input Voltage	$V_{ON/OFF}$	-0.3	60 (or V_{IN})	V
FB pin voltage	V_{FB}	-0.3	25 (or V_{IN})	V
Output voltage to GND	V_{OUT}	-1		V
Storage Temperature Range	T_{STG}	-65	150	℃
Maximum Junction Temperature Range	$T_{J,MAX}$	-	150	℃

POSITIVE VOLTAGE REGULATORS

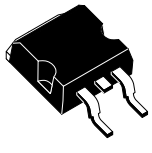
- OUTPUT CURRENT TO 1.5A
- OUTPUT VOLTAGES OF 5; 5.2; 6; 8; 8.5; 9; 10; 12; 15; 18; 24V
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSITION SOA PROTECTION



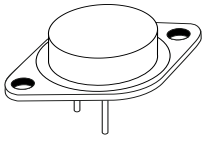
TO-220



TO-220FP
TO-220FM



D²PAK

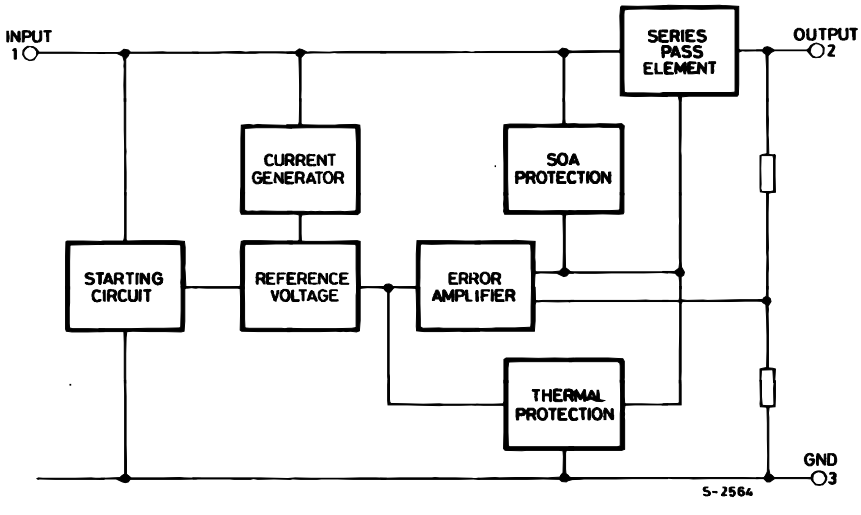


TO-3

DESCRIPTION

The L7800 series of three-terminal positive regulators is available in TO-220, TO-220FP, TO-220FM, TO-3 and D^2PAK packages and several fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

Figure 1: Schematic Diagram



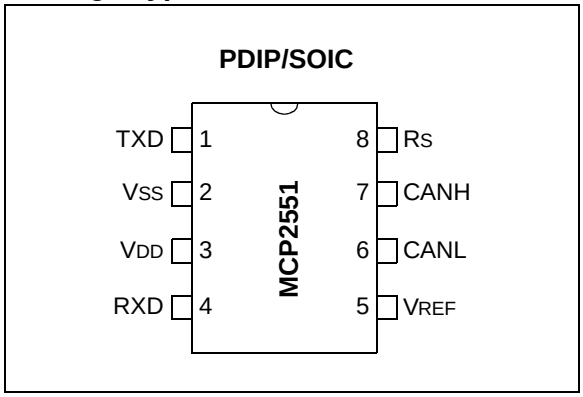
MCP2551

High-Speed CAN Transceiver

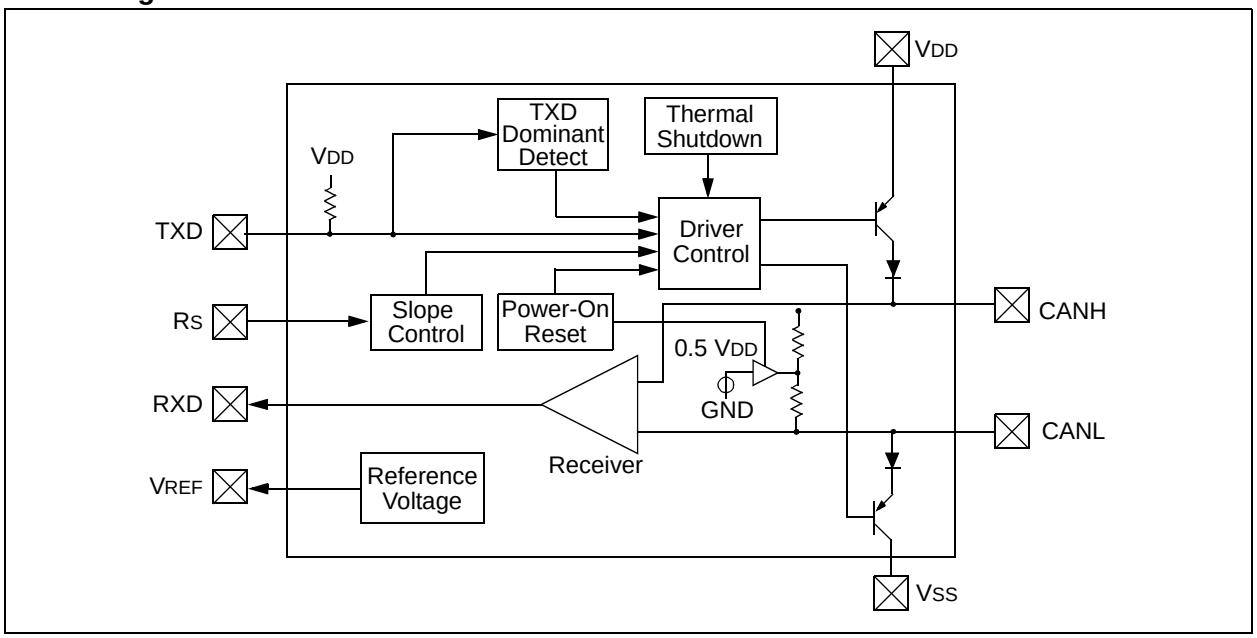
Features

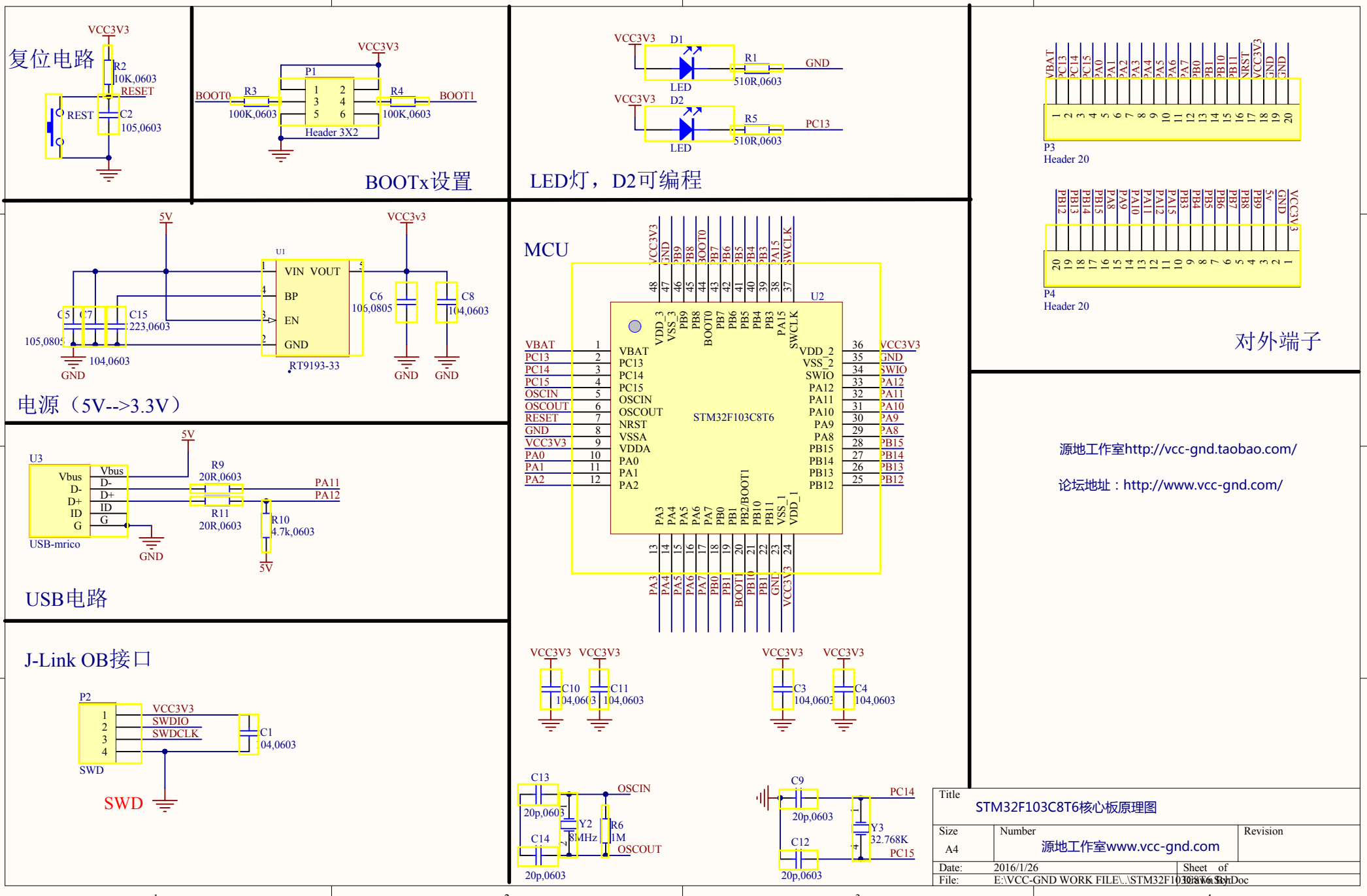
- Supports 1 Mb/s operation
- Implements ISO-11898 standard physical layer requirements
- Suitable for 12V and 24V systems
- Externally-controlled slope for reduced RFI emissions
- Detection of ground fault (permanent Dominant) on TXD input
- Power-on Reset and voltage brown-out protection
- An unpowered node or brown-out event will not disturb the CAN bus
- Low current standby operation
- Protection against damage due to short-circuit conditions (positive or negative battery voltage)
- Protection against high-voltage transients
- Automatic thermal shutdown protection
- Up to 112 nodes can be connected
- High-noise immunity due to differential bus implementation
- Temperature ranges:
  - Industrial (I): -40°C to +85°C
  - Extended (E): -40°C to +125°C

Package Types



Block Diagram




复位电路
VCC3V3
R2
10K,0603
RESET
REST
C2
105,0603
BOOTx设置
P1
BOOT0
R3
100K,0603
R4
BOOT1
Header 3X2
LED灯，D2可编程
D1
R1
510R,0603
GND
LED
D2
R5
PC13
对外端子
P3
Header 20
P4
Header 20
电源（5V-->3.3V）
5V
U1
VIN VOUT
BP
EN
GND
RT9193-33
C5
C7
C15
223,0603
105,0805
104,0603
C6
106,0805
C8
104,0603
MCU
U2
STM32F103C8T6
USB电路
U3
USB-mrico
R9
20R,0603
R11
20R,0603
R10
4.7k,0603
PA11
PA12
J-Link OB接口
P2
SWDIO
SWDCLK
C1
04,0603
SWD
C10
C11
104,0603
C3
C4
C13
20p,0603
Y2
8MHz
R6
1M
OSCIN
OSCOUT
C14
C9
C12
Y3
32.768K
PC14
PC15
源地工作室http://vcc-gnd.taobao.com/
论坛地址：http://www.vcc-gnd.com/
Title
STM32F103C8T6核心板原理图
Size
A4
Number
源地工作室www.vcc-gnd.com
Revision
Date:
2016/1/26
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File:
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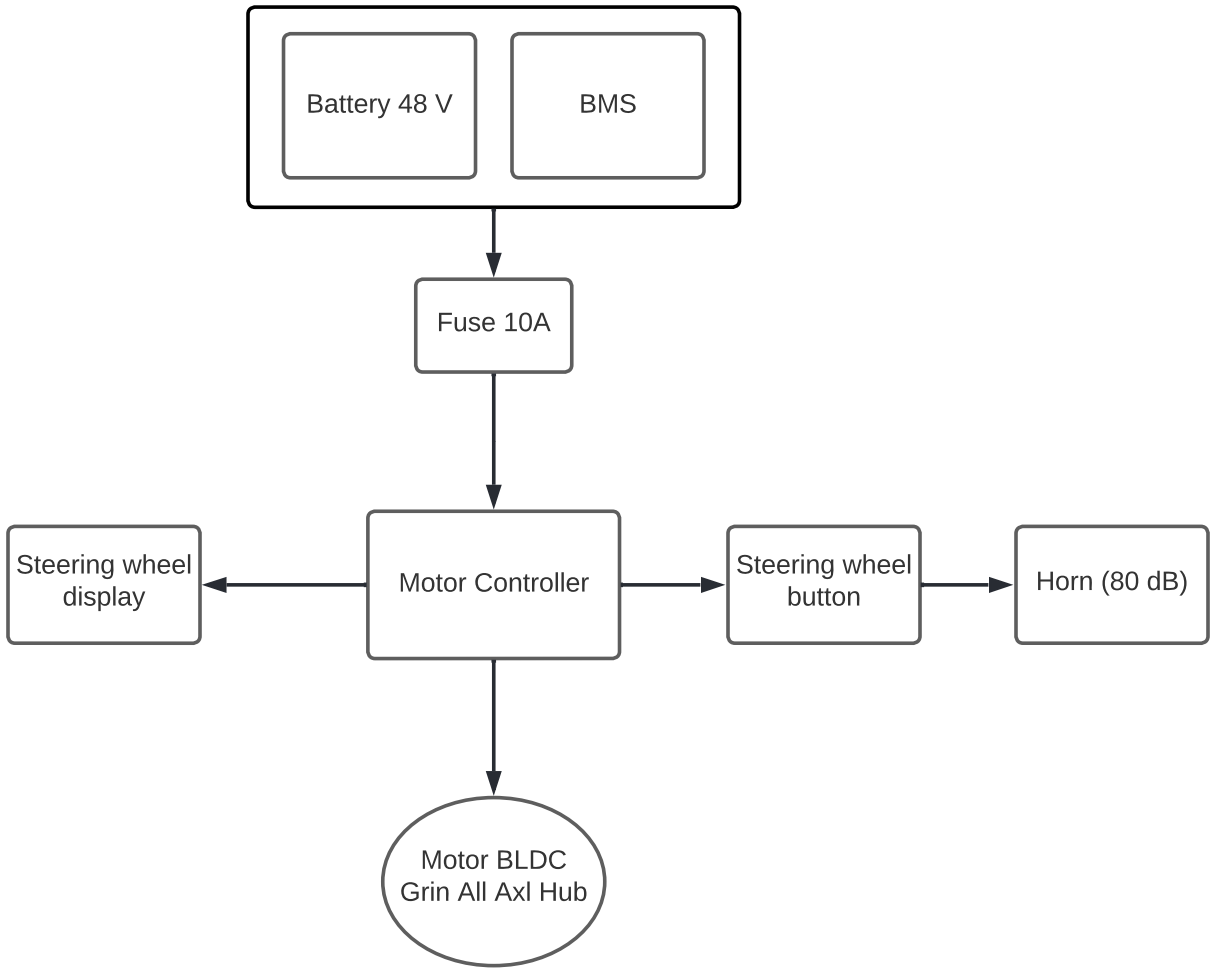
Energy Supply Block Diagram - KON Team Mk III



Propulsion System Block Diagram - KON Team Mk III