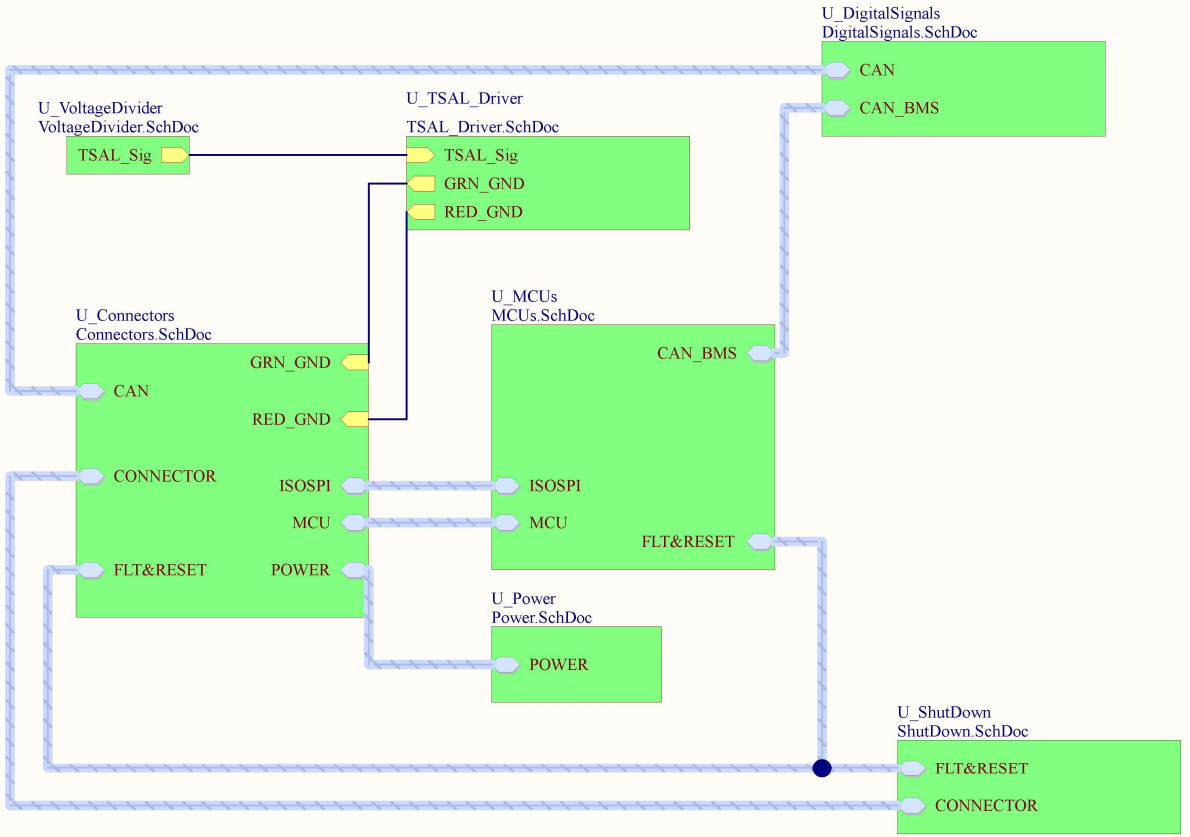
Charging Cart Board.PrjPcb

WISCONSIN FORMULA SAE Racing

Contents

Revision Notes



Title	
*	
Designer	Revision
*	*
Date: 2/9/2025	
File: 01_TopLevel.SchDoc	

WISCONSIN FORMULA SAE Racing

BMS MCU:

Using 3V3 LDO off of th Launchpad for 3V3 Power

LV

MCU1A

J1
- +3.3V — 1
- PB5/AIN11/CAN0Tx/M0PWM3/SSI2Fss/T1CCP1 — 2
- PB0/T2CCP0/U1Rx/USB0ID — 3
- PB1/T2CCP1/U1Tx/USB0VBUS — 4 — nBMS_FAULT
- PE4/AIN9/CAN0Rx/I2C2SCL/M0PWM4/M1PWM2/U5Rx — 5 — CANRX_BMS
- PE5/AIN8/CAN0Tx/I2C2SDA/M0PWM5/M1PWM3/U5Tx — 6 — CANTX_BMS
- PB4/AIN10/CAN0Rx/M0PWM2/SSI2Clk/T1CCP0 — 7
- PA5/SSI0TX — 8
- PA6/I2C1SCL/M1PWM2 — 9 — AIR_COIL_DSP
- PA7/I2C1SDA/M1PWM3 — 10

TM4C_Launchpad

R1 0.01 1% 0603 — 3V3

MCU1B

J2
- GND — 11 — GND
- PB2/I2C0SCL/T3CCP0 — 12
- PE0/AIN3/U7Rx — 13 — SDC_SUPPLY_DSP
- PF0/C0o/CAN0Rx/M1PWM4/NMI/PhA0/SSI1Rx/T0CCP0/U1RTS — 14 — SDC_RETURN_DSP
- !TARGETRST — 15
- PB7/M0PWM1/SSI2Tx/T0CCP1 — 16
- PB6/M0PWM0/SSI2Rx/T0CCP0 — 17
- PA4/SSI0RX — 18
- PA3/SSI0FSS — 19
- PA2/SSI0CLK — 20

TM4C_Launchpad

MCU1C

J3
- VBUS — 21 — 5V
- GND — 22 — GND
- PD0/AIN7/I2C3SCL/MOPWM6/M1PWM0/SSI1Clk/SSI3Clk/WT2CCP0 — 23 — 6820_SCK
- PD1/AIN6/I2C3SDA/MOPWM7/M0PWM1/SSI1Fss/SSI3Fss/WT2CCP1 — 24 — 6820_CS
- PD2/AIN5/MOFAULT0/SSI1Rx/SSI3Rx/USB0EPEN/WT3CCP0 — 25 — 6820_MISO
- PD3/AIN4/IDX0/SSI1Tx/SSI3Tx/USB0PFLT/WT3CCP1 — 26 — 6820_MOSI
- PE1/AIN2/U7Tx — 27 — nIMD_FAULT_DSP
- PE2/AIN1 — 28 — GLV_DSP
- PE3/AIN0 — 29
- PF1/C1o/M1PWM5/PhB0/SSI1Tx/T0CCP1/TRD1/U1CTS — 30

ISOSPI: 6820_SCK, 6820_CS, 6820_MISO, 6820_MOSI → ISOSPI

TM4C_Launchpad

MCU1D

J4
- PF2/M0FAULT0/M1PWM6/SSI1CLK/T1CCP0/TRD0 — 31 — HS_PG
- PF3/CAN0Tx/M1PWM7/SSI1Fss/T1CCP1/TRCLK — 32 — HS_EN
- PB3/I2C0SDA/T3CCP1 — 33 — HS_SDA
- PC4/C1-/IDX1/ID0PWM6/U1RTS/U1Rx/U4Rx/WT0CCP0 — 34 — IMD_LED_GPIO
- PC5/C1+/M0PWM7/PhA1/U1CTS/U1Tx/U4Tx/WT0CCP1 — 35
- PC6/C0+/PhB1/U3Rx/USB0EPEN/WT1CCP0 — 36
- PC7/C1-/U3Tx/USBPFLT/WT1CCP1 — 37
- PD6/M0FAULT0/PhA0/U2Rx/WT5CCP0 — 38
- PD7/NMI/PhB0/U2Tx/WT5CCP1 — 39 — SDC_ACCUM_DSP
- PF4/IDX0/MIFAULT0/T2CCP0/USB0EPEN — 40

TM4C_Launchpad

WR1

WISCONSIN RACING

WR Logo

Harnesses

CAN BMS
- CANTX_BMS → CAN0TX_BMS
- CANRX_BMS → CAN0RX_BMS

→ CAN_BMS

Faults and resets
- SDC_RESET → SDC_RESET
- nBMS_FAULT → nBMS_FAULT
- nIMD_FAULT → nIMD_FAULT
- IMD_LED_GPIO → IMD_LED_GPIO

→ FLT&RESET

MCU
- AIR_COIL+ → AIR_COIL+
- SDC_ACCUM → SDC_ACCUM
- SDC_SUPPLY → SDC_SUPPLY
- SDC_RETURN → SDC_RETURN
- nIMD_FAULT → nIMD_FAULT

→ MCU

12V Signals:

GLV → R29 10K 1% 0603 → GLV_DSP
- C17 0.1uF 0603
- R30 2.49K 0603
- D6
- GND

nIMD_FAULT → R25 10K 1% 0603 → nIMD_FAULT_DSP
- C18 0.1uF 0603
- R31 2.49K 0603
- D26
- GND

SDC_RETURN → R28 10K 1% 0603 → SDC_RETURN_DSP
- C19 0.1uF 0603
- R32 2.49K 0603
- D28
- GND

SDC_SUPPLY → R33 10K 1% 0603 → SDC_SUPPLY_DSP
- C20 0.1uF 0603
- R35 2.49K 0603
- D29
- GND

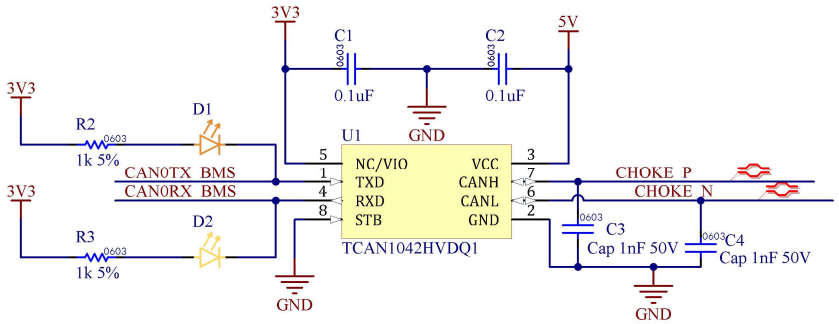
SDC_ACCUM → R34 10K 1% 0603 → SDC_ACCUM_DSP
- C21 0.1uF 0603
- R36 2.49K 0603
- D30
- GND

AIR_COIL+ → R37 10K 1% 0603 → AIR_COIL_DSP
- C22 0.1uF 0603
- R38 2.49K 0603
- D31
- GND

Title	*MCU*
Designer	*Krish Isserdasani*
Revision	*223*
Date	2/9/2025
File	MCUs.SchDoc

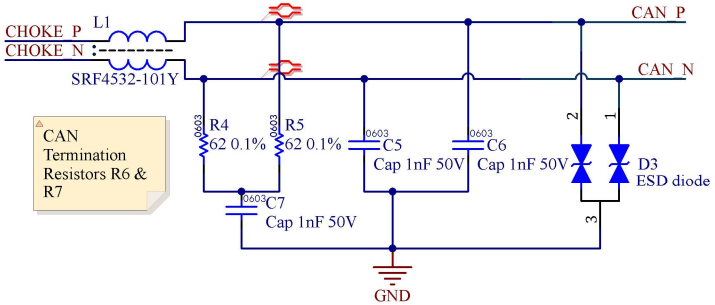
WISCONSIN FORMULA SAE Racing

BMS CAN Transceiver



If using in noisy area or with SMPS, can add extra 10uF bypass caps to both the VIO and VCC lines

Once per bus connections



CAN Layout

CAN LAYOUT

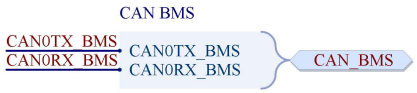
TVS diodes and bus filtering capacitors should be placed as close to the on-board connectors as possible to prevent noisy transient events from propagating further into the PCB and system.

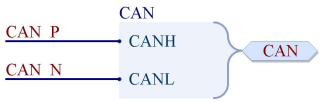
Each bypass capacitor should have two of its own grounding vias

Is differential, not critical, but try to make the traces routed together

Given the choice make CAN_H and CAN_L longer versus TX and RX

Signal Harnesses





Title	***Digital Signals***
Designer: ***Christian Schuster***	Revision: ***223.1***
Date: 2/9/2025	
File: DigitalSignals.SchDoc	

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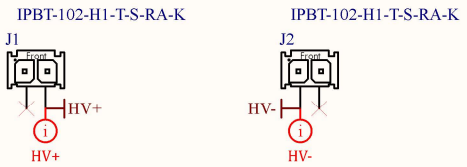
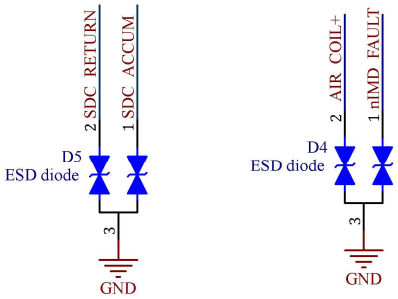
HV CONNECTORS

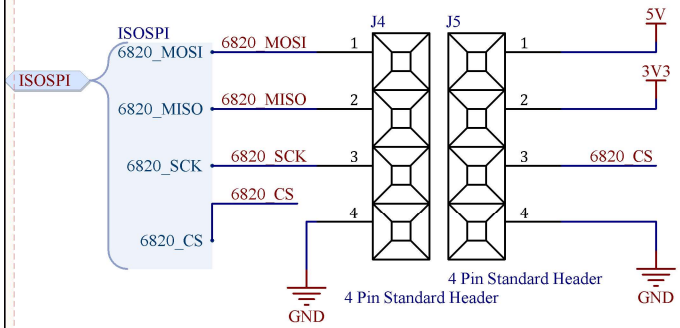


ESD Diodes

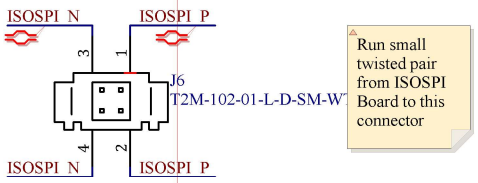


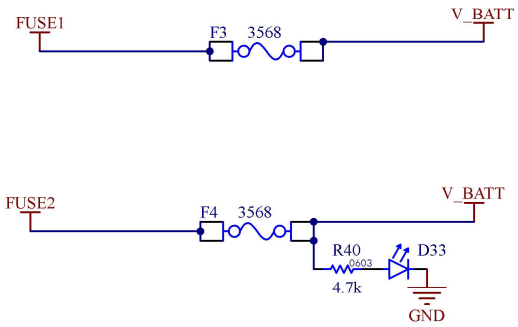
ISOSPI Board

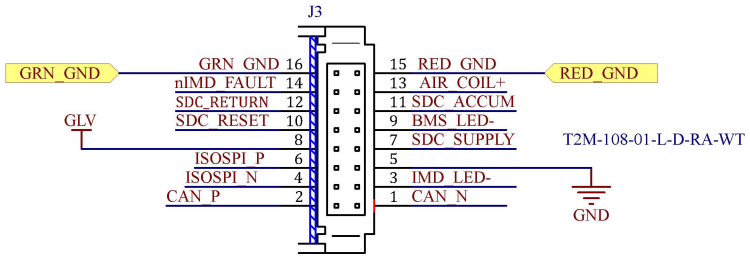
Headers

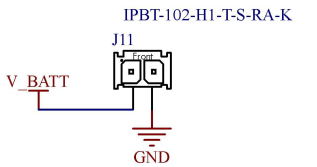


ISOSPI

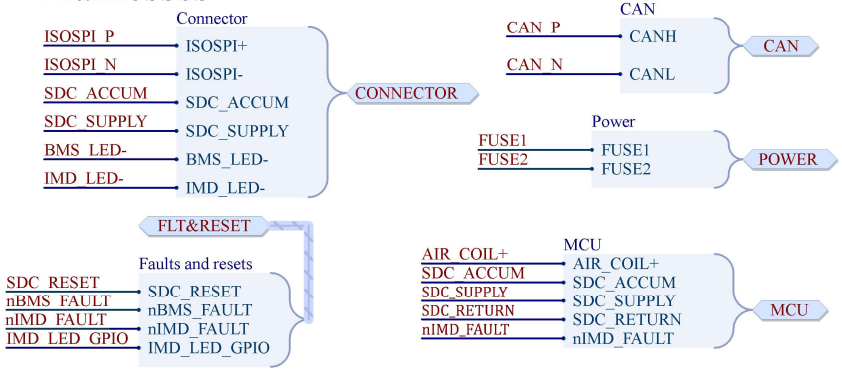








Harnesses



Title	***Connectors***
Designer	***Alex Grotelueschen***
Revision	***223.1***
Date:	2/9/2025
File:	Connectors.SchDoc

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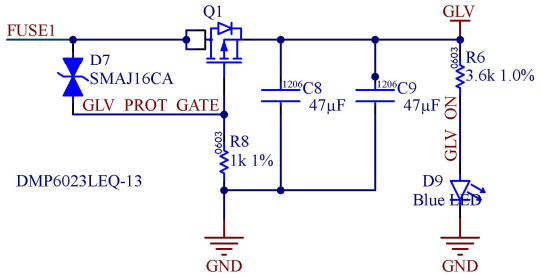
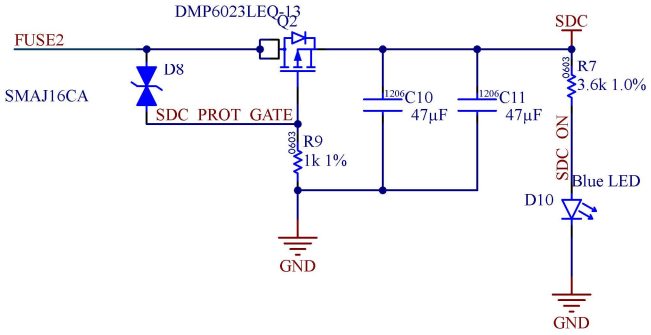
GLV Connection and Protection



Reverse Voltage P-FET
Pin 3 = Drain, 2 = Source, 1 = Gate
Rds(on) typical = 28mOhms
Max I(D) = 7A

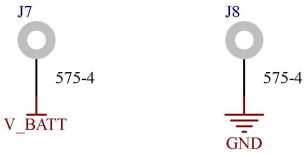
SDC Power and Protection



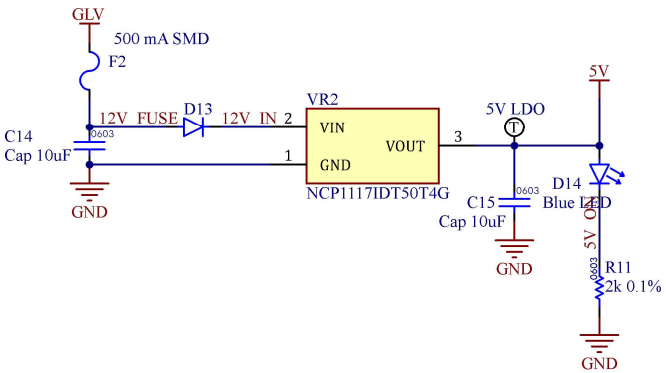
Reverse Voltage P-FET
Pin 3 = Drain, 2 = Source, 1 = Gate
Rds(on) typical = 28mOhms
Max I(D) = 7A

Harness

Banana jacks



BMB 5V LDO



This LDO is used for any 5V items on the BMB: BPD, ISOSPI DB, HVDB, etc.

RthJA = 67C/W
TjMax = 150C
TjShutdown 175C
PMax = (150 - T(Ambiant))/67
PMax(@25C) = 1.8W
Imax(@25C) = 1.8W / (12V-5V) = 260mA
PMax(@65C) = 1.27W
Imax(@65C) = 180mA

Title	***Power***	
Designer	***Krish Isserdasani***	Revision ***223***
Date:	2/9/2025	
File:	Power.SchDoc	

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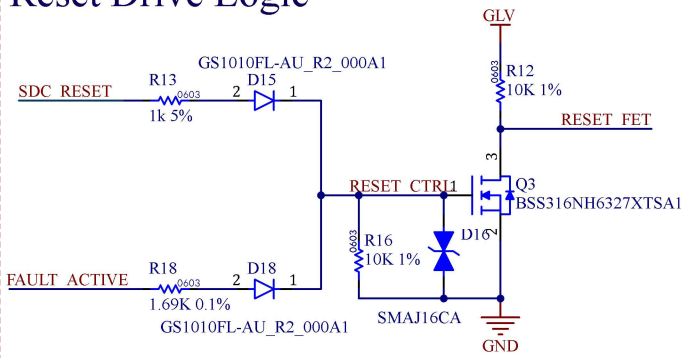
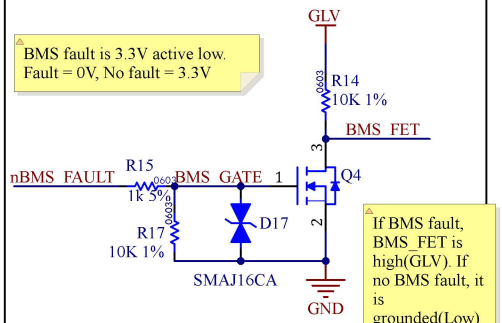
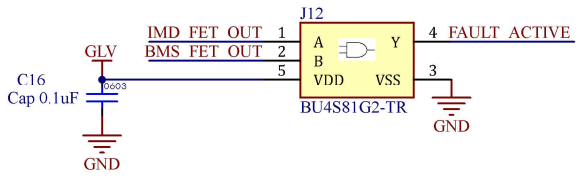
Reset Drive Logic



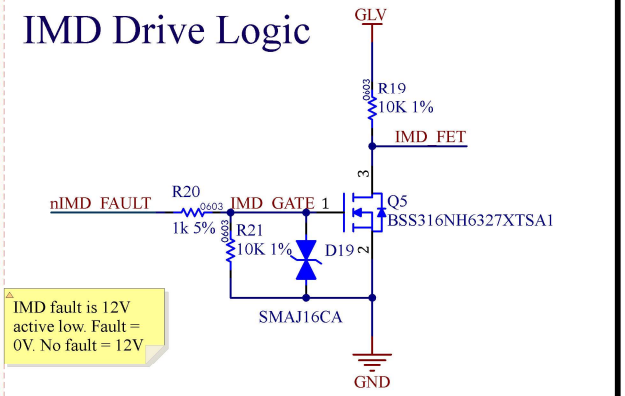
BMS Drive Logic

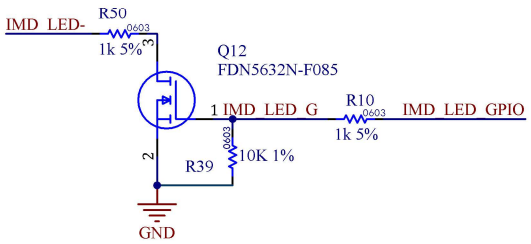


Fault Latching Logic

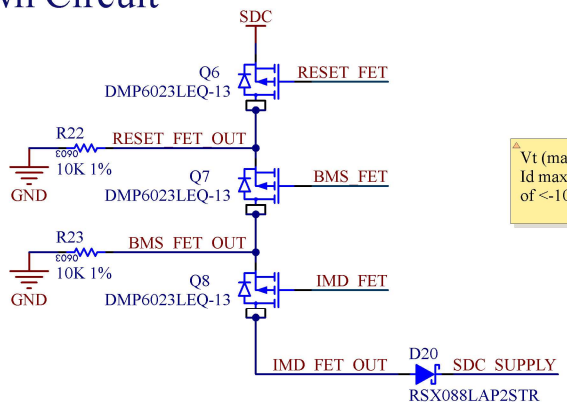


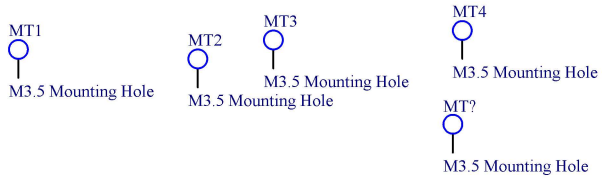
IMD Drive Logic



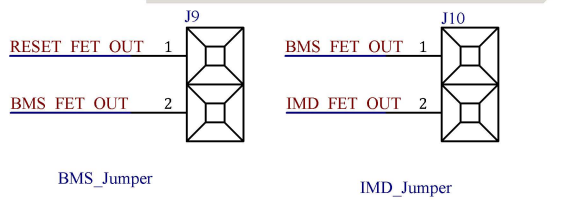


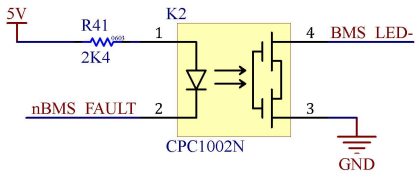
Shutdown Circuit



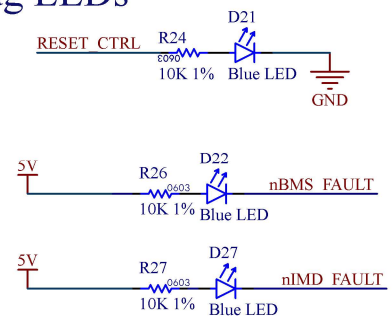


Jumpers

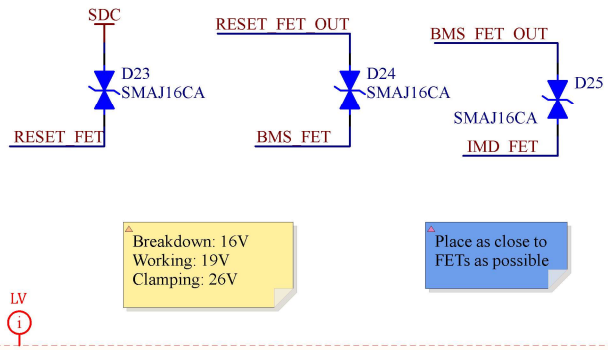




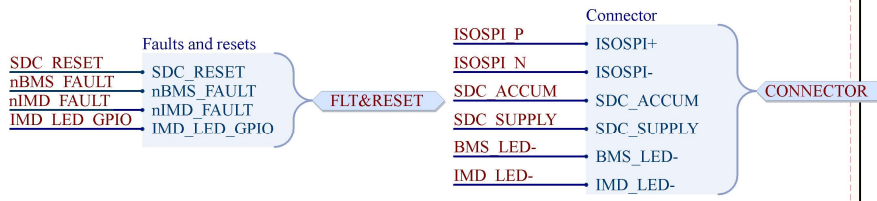
Debug LEDs



TVS Diodes



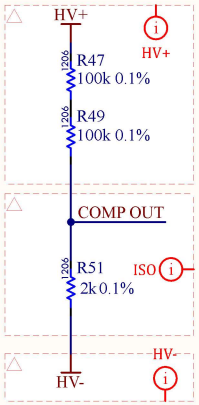
Harnesses



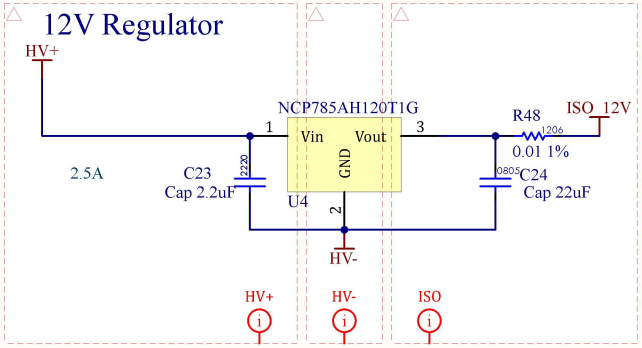
Title	***Shutdown Circuit***
Designer	***Pratham & Krish***
Revision	***223.2***
Date:	2/9/2025
File:	ShutDown.SchDoc

WISCONSIN FORMULA SAE Racing

Voltage Divider

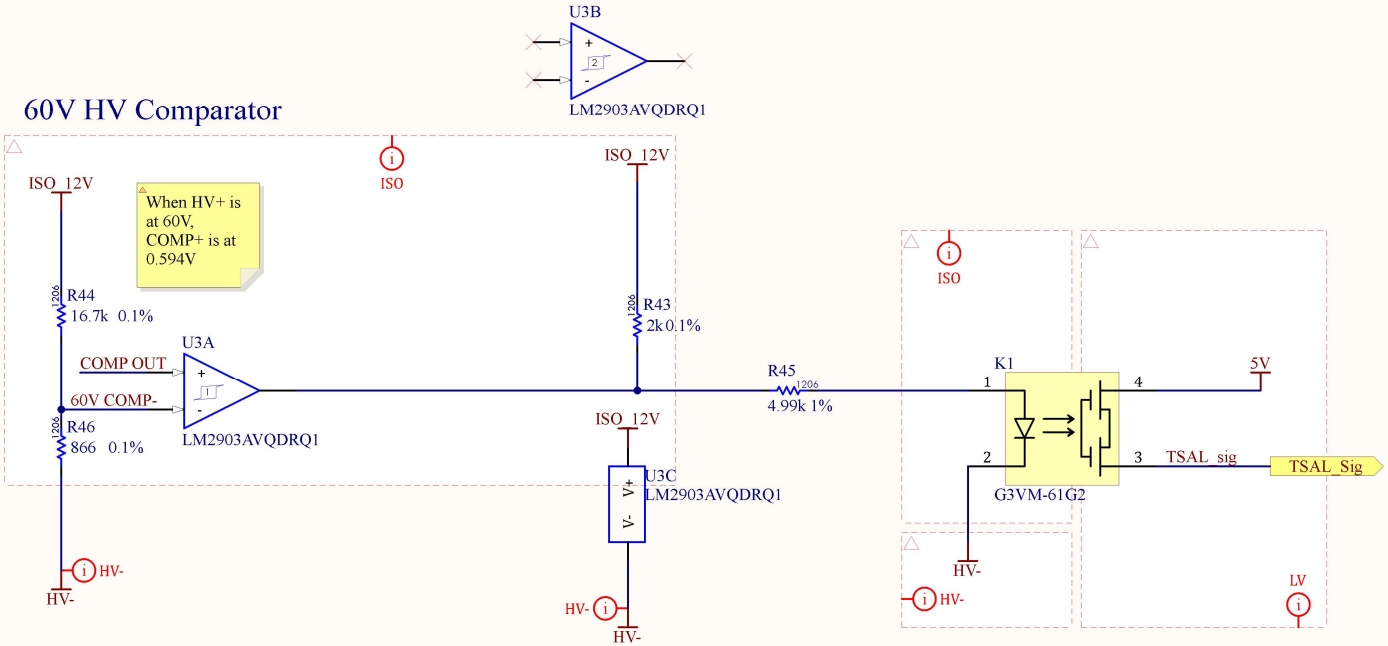


12V Regulator



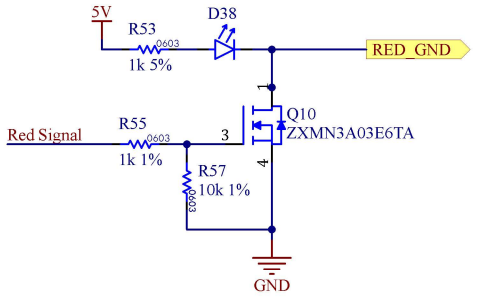
HV Label

60V HV Comparator

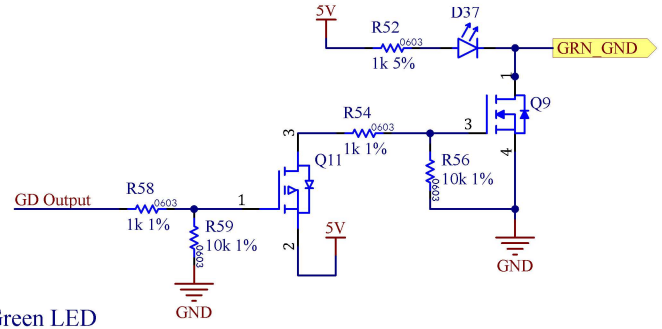


Title	*TSAL Comparator*
Designer	*Krish Isserdasani*
Revision	*223.1*
Date:	2/9/2025
File:	VoltageDivider.SchDoc

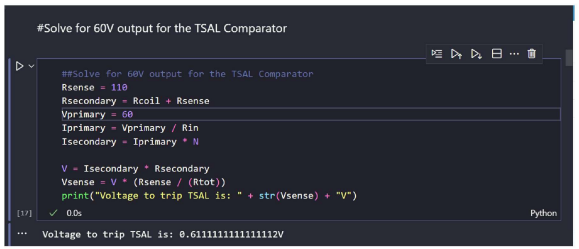
WISCONSIN FORMULA SAE Racing



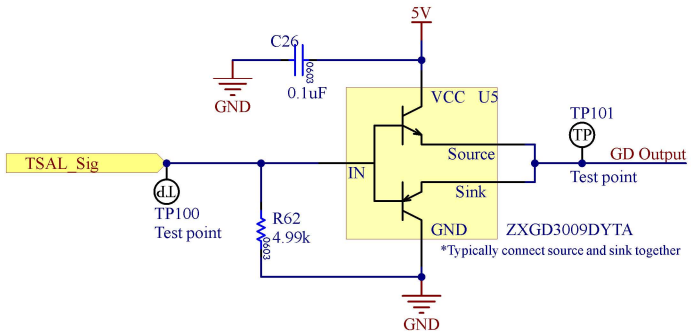
Red LED



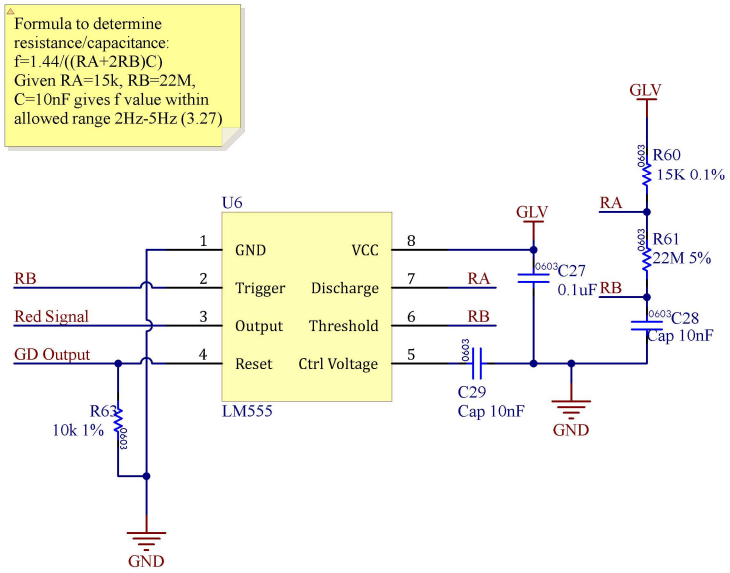
Green LED



Math



Comparator Circuit



Timing Circuit

LV

Title: *TSAL Driver*	
Designer: *Krish Isserdasani*	Revision: *223.1*
Date: 2/9/2025	
File: TSAL_Driver.SchDoc	

WISCONSIN FORMULA SAE Racing