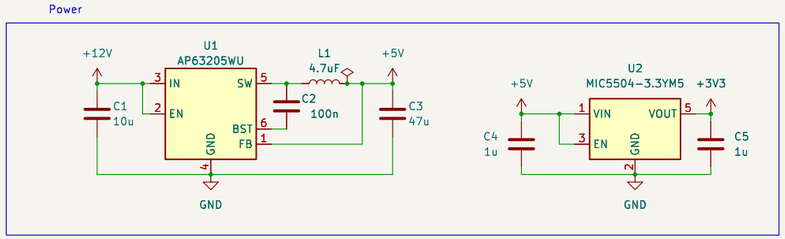
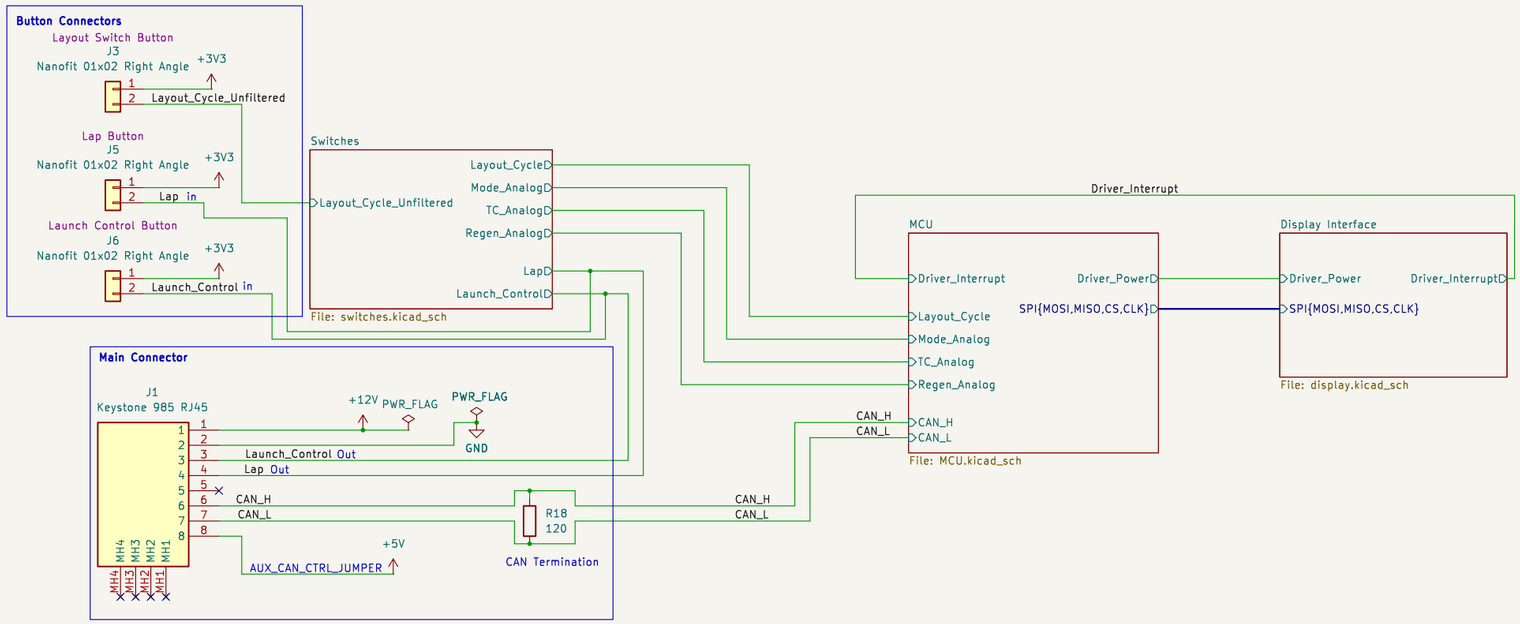




Jesse Osteen, Brian Acosta
Nova Mondal
Formula Slug

Sheet: /
File: steering_wheel.kicad_sch

Title: Steering Wheel Board

Size: B	Date: 2026-01-23	**Rev: 1.0**
KiCad E.D.A. 9.0.6		Id: 1/4

All filtering capacitor values are taken from BT817Q datasheet

+3V3 C11 100n GND
+3V3 C12 100n GND
+3V3 C13 100n GND
+3V3 C14 100n GND
+1V2 C10 10u GND
+1V2 C8 100n GND
+1V2 C9 1u GND
+1V2 C15 100n GND

U4
BT817Q

VCC 24, VCCIO1 9, VCCIO2 28, VCCIO3 17, VOUT1V2 25, VCC1V2 2, VCC1V2 57, VCCA 21

SPI{MOSI,MISO,CS,CLK} → SPI.CLK 3 SCK, SPI.MISO 4 MISO, SPI.MOSI 5 MOSI, SPI.CS 6 CS_N
GPIO0/IO2 7, GPIO1/IO3 8, GPIO2 10
Driver_Power → PD_N 12
GPIO3 13, SPIM_SCLK 14, SPIM_SS_N 15, SPIM_MOSI 16, SPIM_MISO 18, SPIM_IO2 19, SPIM_IO3 20, X1/CLK 21, X2 22, AUDIO_L 26, CTP_RST_N 29, CTP_INT_N 30, CTP_SCL 31, CTP_SDA 32

R0 1 RGB_R0, R1 64 RGB_R1, R2 63 RGB_R2, R3 62 RGB_R3, R4 61 RGB_R4, R5 60 RGB_R5, R6 59 RGB_R6, R7 58 RGB_R7
G0 56 RGB_G0, G1 55 RGB_G1, G2 54 RGB_G2, G3 53 RGB_G3, G4 52 RGB_G4, G5 51 RGB_G5, G6 50 RGB_G6, G7 49 RGB_G7
B0 47 RGB_B0, B1 46 RGB_B1, B2 45 RGB_B2, B3 44 RGB_B3, B4 43 RGB_B4, B5 42 RGB_B5, B6 41 RGB_B6, B7 40 RGB_B7
PCLK 39 LCD_Dot_Clock
DISP 38 LCD_Display_Enable
HSYNC 37 LCD_HSync
VSYNC 36 LCD_VSync
DE 35 LCD_Data_Enable
BACKLIGHT 34 Backlight_PWM
INT_N 11 → Driver_Interrupt (to MCU)

GND 65, GND 33, GND 23, GND 48 → GND

Note: using single SPI
because firmware has decided that
SPI data rate is not the primary performance bottleneck
and the QSPI compatible STM32 is much larger
see
https://fsae.slack.com/archives/C07NHPGM5EE/p1766291511492069

Bridgetek Display Driver

RGB_R[0..7]
RGB_G[0..7]
RGB_B[0..7]
LCD_Dot_Clock
LCD_Display_Enable
LCD_HSync
LCD_VSync
LCD_Data_Enable

J4
Conn_01x40

LED_Low 1, LED_High 2, GND 3, +3V3 4
RGB_R0 5, RGB_R1 6, RGB_R2 7, RGB_R3 8, RGB_R4 9, RGB_R5 10, RGB_R6 11, RGB_R7 12
RGB_G0 13, RGB_G1 14, RGB_G2 15, RGB_G3 16, RGB_G4 17, RGB_G5 18, RGB_G6 19, RGB_G7 20
RGB_B0 21, RGB_B1 22, RGB_B2 23, RGB_B3 24, RGB_B4 25, RGB_B5 26, RGB_B6 27, RGB_B7 28
GND 29, LCD_Dot_Clock 30, LCD_Display_Enable 31, LCD_HSync 32, LCD_VSync 33, LCD_Data_Enable 34
35, 36, 37 GND, 38, 39, 40
MP

Pins 37–40 are resistive touch pins
Unused for our application

Pin assignments given on page 5 of Crystalfontz
CFAF800480H0-043Sx datasheet

40 Pin FPC ZIF connector

+12V
NOTE: different from the other 1u caps!
Higher voltage rating
C25 1u
MFG PN: CL10B105KA8NNNC
GND

L3 22u

U7
AP3019AKTR

Backlight_Switch 1 → SW
VIN 6
GND 2
Backlight_PWM 4 → CTRL
FB 3 ← LED_Low
VOUT 5 → LED_High

C24 220n
LED_High
Test Point J12 Test Pad
LED_Low
Test Point J11 Test Pad
Test Point Backlight_PWM 1 J10 Test Pad

R11
4.99 ohm ±1% 1/2 W
1210 form factor is the smallest SMD
resistor that can be 1/2 watt

Backlight Driver Circuit

AP3019A datasheet application circuit (page 2) specs
a SUMIDA CDRH5D28R-220NC or equivalent inductor

C25 value comes from Cin in the AP3019A datasheet page 2

L value taken from AP3019A datasheet Page 1 and 2

C25, C24 should be X7R or X5R as specified in the application circuit on page 2 of the AP3019A datasheet

C25: 20 V rating
Automotive 12V can be up to 14V while running
14V/0.8 = 17.5 with 80% safety factor, round up to 20

C24 value comes from Cout in the application circuit given in the AP3019A datasheet (page 2)

C24 should be rated to >= 40V
AP3019A Overvoltage cap is 30V, with 80% safety factor
30/0.8 = 37.5 V, round up to 40V

Feedback Resistor Calculation:

Feedback bias voltage = 200mV
Backlight current is specced to be 40mA by the
TFT screen datasheet, page 6
(https://www.crystalfontz.com/products/document/4905/CFAF800480H0-043SxTFTFamilyDatasheet.pdf)

Vfb = I*Rfb
Rfb = Vfb/I = 200mv/40ma = 5ohm

Power = R*V^2
= 5ohm * (200mV)^2 = 200mW

Should rate to 1/2W for safety factor and to account for heating

Tolerance: 1% tolerance worst case –>
4.95 Ohm –> I = 200mV/4.95ohm
= 40.4 mA instead of 40 mA

Jesse Osteen, Brian Acosta
Nova Mondal
Formula Slug

Sheet: /Display Interface/
File: display.kicad_sch

Title: Steering Wheel Board

Size: B	Date: 2026-01-23	**Rev: 1.0**
KiCad E.D.A. 9.0.6		Id: 2/4

Mode_Analog
Regen_Analog

STM32G441KBTx MCU

Decoupling 100nF capacitors need to be placed as close to respective Vdd/Vss as possible. Note that VSS contains all VSS mcu pins for each VDD/VSS pair.

FB1
FCM 1608KF-601T03
+3V3
PWR_FLAG
+3V3_A
C19 10u
C20 100n
C21 100n
C22 1u
C23 100nF
GND

SW1
Y97KT23B5NAFP
C18 100n

U5
STM32G441KBTx

C16 6.8pF
Y1 24MHz
ECS-240-8-37B-CKY-TR
C17 6.8pF

NRST
OSC_IN
OSC_OUT
TC_Analog
STLINK_SWO
Layout_Cycle
Driver_Interrupt
BOOT0

PG10
RCC_OSC_IN
RCC_OSC_OUT
ADC1_IN15
SYS_JTDO-SWO
PB4
PB5
PB6
PB7
PB8

ADC1_IN1 5 Regen_Analog
ADC1_IN2 6 Mode_Analog
USART2_TX 7 VCP_UART_TX
USART2_RX 8 VCP_UART_RX
SPI1_NSS 9 SPI.CS
SPI1_SCK 10 SPI.CLK
SPI1_MISO 11 SPI.MISO
SPI1_MOSI 12 SPI.MOSI
PA8 18
PA9 19
PA10 20
FDCAN1_RX 21 CAN_RX
FDCAN1_TX 22 CAN_TX
SYS_JTMS-SWDIO 23 STLINK_SWDIO
SYS_JTCK-SWCLK 24 STLINK_SWCLK
PA15 25 Driver_Power

SPI.CS
SPI.CLK
SPI.MISO
SPI.MOSI
SPI{MOSI,MISO,CS,CLK}
Driver_Power

R1 10k

ST-Link Programming/Debugging Connector
J2
FTSH-107-01-F-DV-K-P-TR
GNDDETECT
VCP_UART_RX
VCP_UART_TX

TC_Analog
Layout_Cycle
Driver_Interrupt

+3V3
R2 4.7k
Driver_Interrupt

CAN

+5V
+3V3
C6 100n
C7 100n
U3
ISO1044BD
VCC2 VCC1
CANH RXD
CANL TXD
GND2 GND1

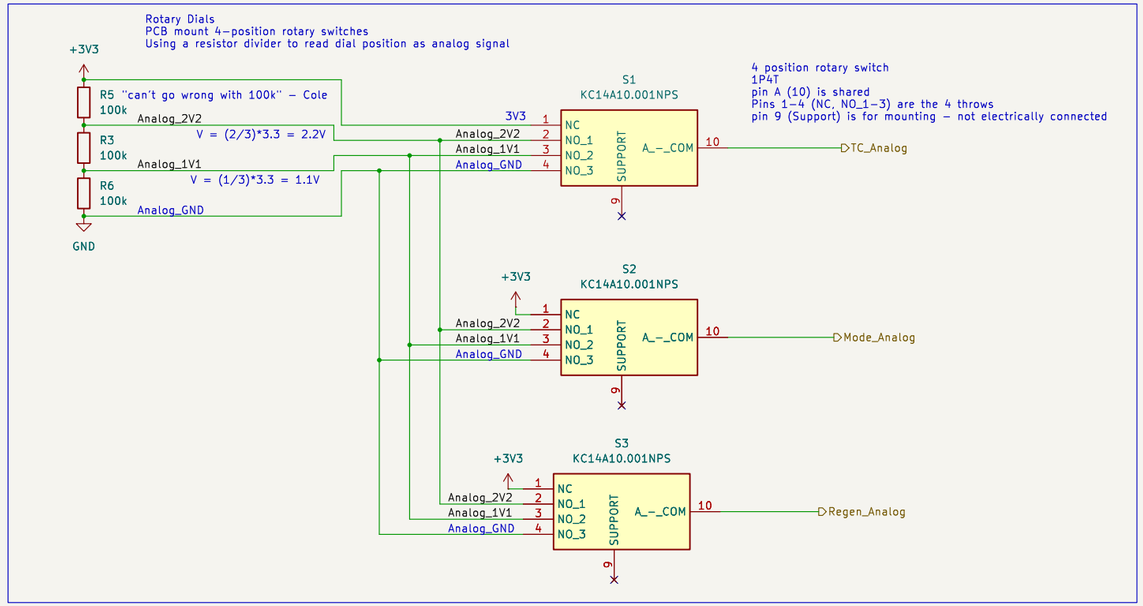
CAN_H
CAN_L
CAN_RX
CAN_TX

Jesse Osteen, Brian Acosta
Nova Mondal
Formula Slug

Sheet: /MCU/
File: MCU.kicad_sch

Title: Steering Wheel Board

Size: B | Date: 2026-01-23 | **Rev: 1.0**
KiCad E.D.A. 9.0.6 | Id: 3/4



Rotary Dials

Buttons

Jesse Osteen, Brian Acosta Nova Mondal **Formula Slug**		
Sheet: /Switches/ File: switches.kicad_sch		
Title: Steering Wheel Board		
Size: B	Date: 2026-01-23	**Rev: 1.0**
KiCad E.D.A. 9.0.6		Id: 6/4