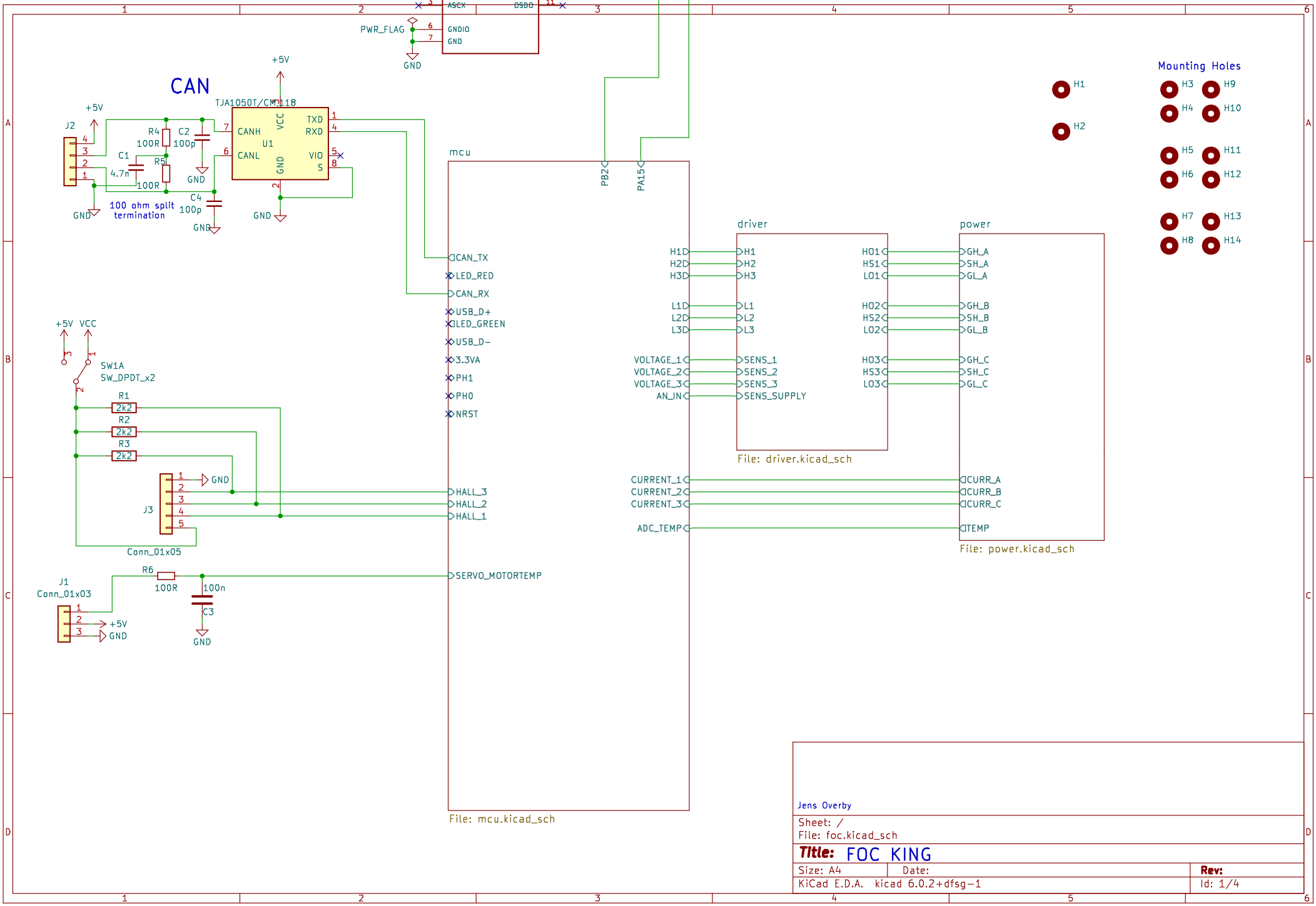
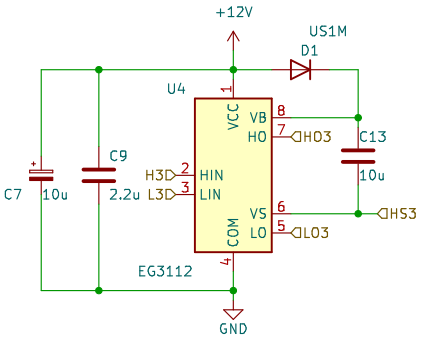
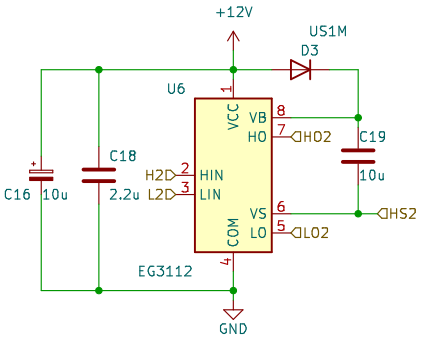
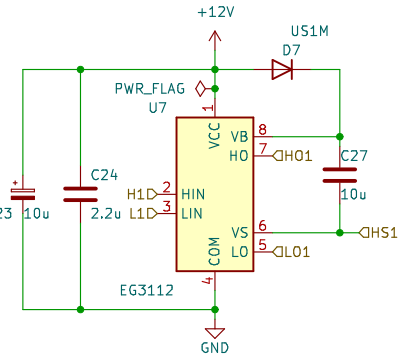
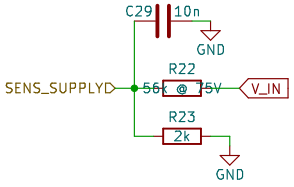
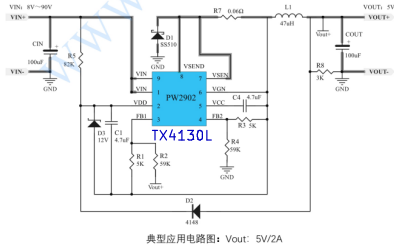

SDD
ASDX
ASCX
OCSB
OSDO
GND
PWR_FLAG
GNDIO
CAN
+5V
TJA1050T/CM1118
U1
CANH
CANL
VCC
GND
TXD
RXD
VIO
S
J2
R4
100R
C2
100p
C1
4.7n
R5
100R
C4
100p
100 ohm split termination
mcu
PB2
PA15
CAN_TX
LED_RED
CAN_RX
USB_D+
LED_GREEN
USB_D-
3.3VA
PH1
PH0
NRST
SW1A
SW_DPDT_x2
VCC
R1
2k2
R2
2k2
R3
2k2
J3
Conn_01x05
HALL_3
HALL_2
HALL_1
R6
100R
100n
C3
J1
Conn_01x03
SERVO_MOTORTEMP
driver
H1
H2
H3
L1
L2
L3
VOLTAGE_1
VOLTAGE_2
VOLTAGE_3
AN_IN
SENS_1
SENS_2
SENS_3
SENS_SUPPLY
HO1
HS1
LO1
HO2
HS2
LO2
HO3
HS3
LO3
File: driver.kicad_sch
power
GH_A
SH_A
GL_A
GH_B
SH_B
GL_B
GH_C
SH_C
GL_C
CURRENT_1
CURRENT_2
CURRENT_3
ADC_TEMP
CURR_A
CURR_B
CURR_C
TEMP
File: power.kicad_sch
File: mcu.kicad_sch
Mounting Holes
H1
H2
H3
H4
H5
H6
H7
H8
H9
H10
H11
H12
H13
H14
Jens Overby
Sheet: /
File: foc.kicad_sch
Title: FOC KING
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 6.0.2+dfsg-1
Id: 1/4







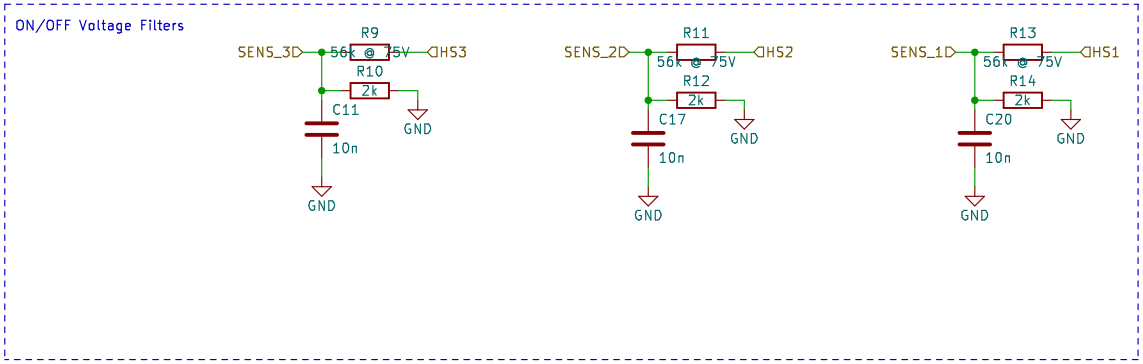


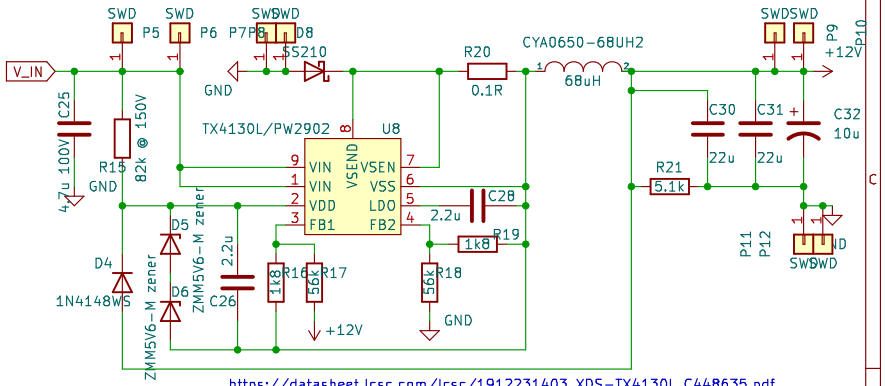


典型应用电路图：Vout: 5V/2A

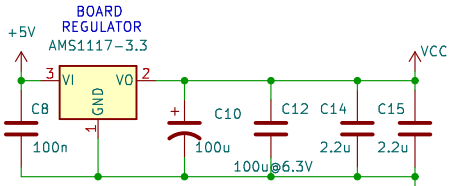
TX4130L:
VFB: min=369 typ=380 max=391 mV
VCS: min=145 typ=150 max=155 mV

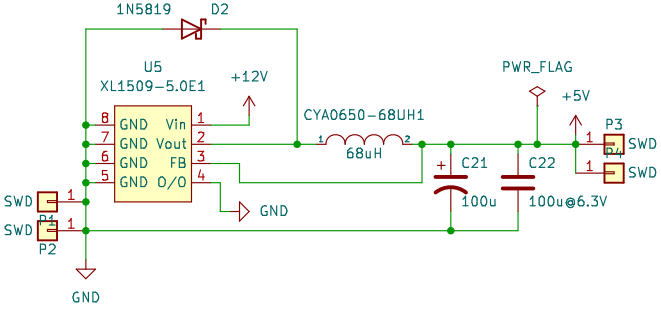
R1 = R3
R2 = R4
Vout= VFB * (R2+R1)/R1
Iout=VCS/R7 (R7=0.06R -> Io=2.6A)
Frequency: Fixed 140kHz
Inductance: 33uH-100uH





https://datasheet.lcsc.com/lcsc/1912231403_XDS-TX4130L_C448635.pdf
https://www.pwchip.com/en/product/PW2902-174.html



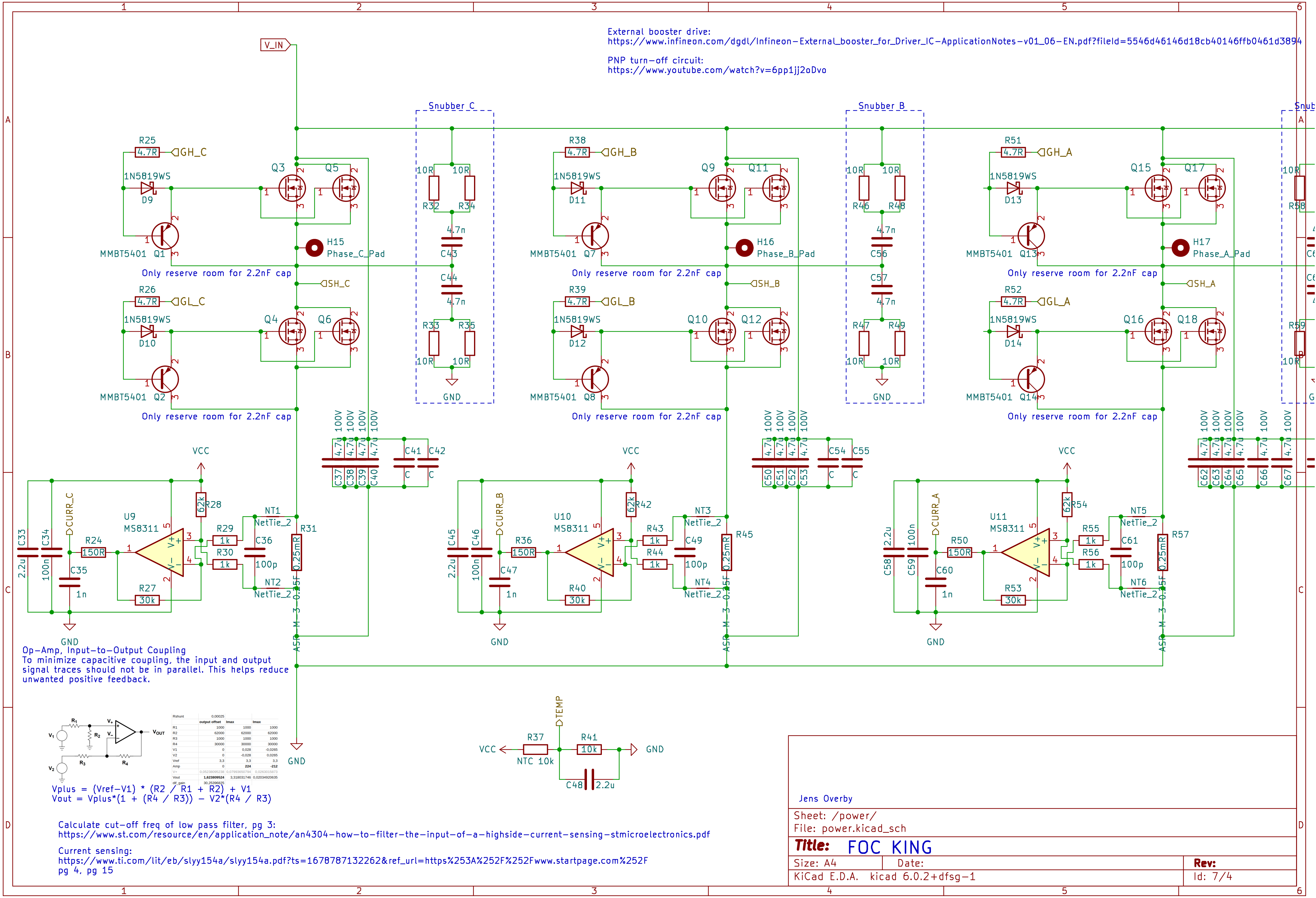


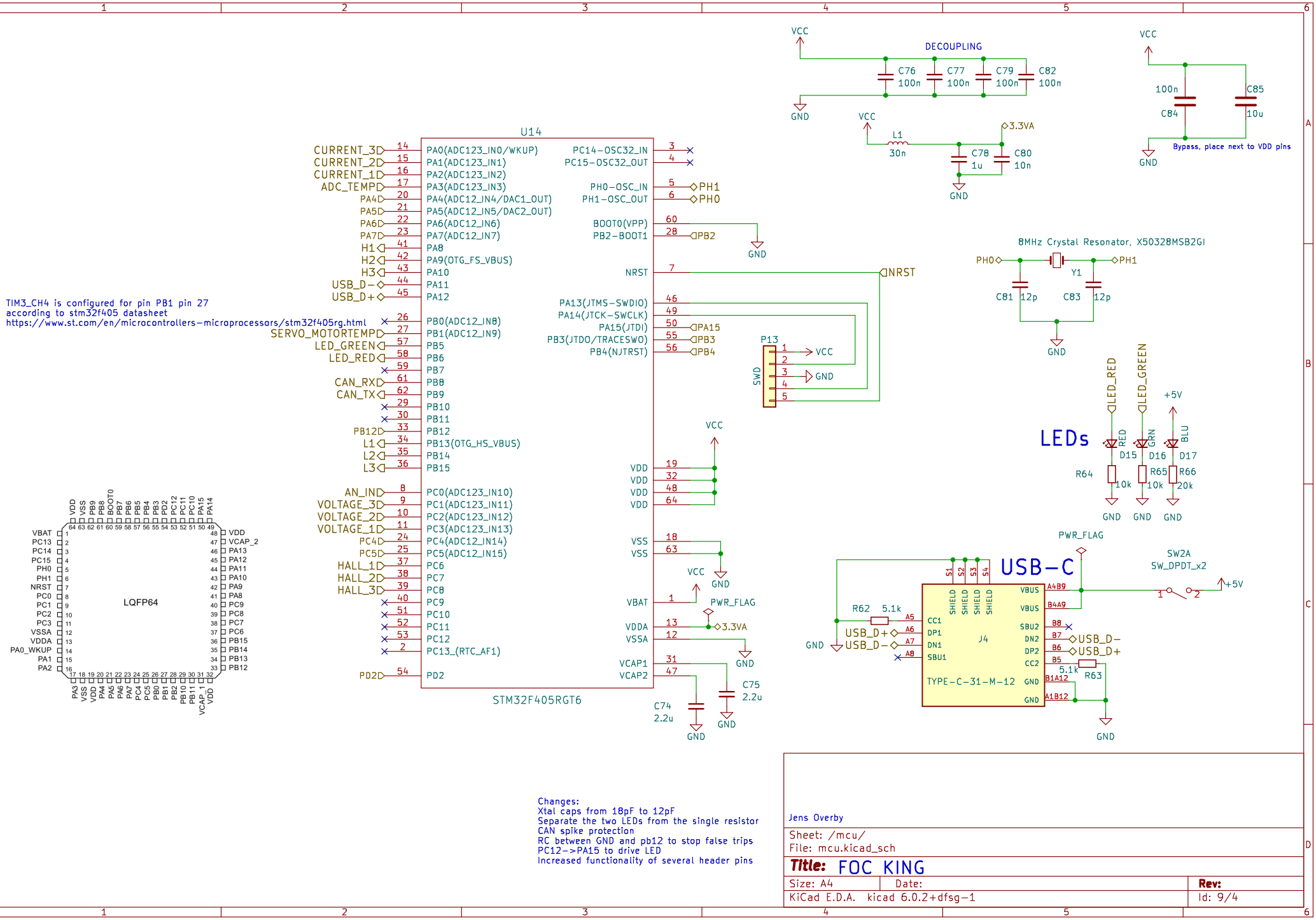
Jens Overby

Sheet: /driver/
File: driver.kicad_sch

Title: FOC KING

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 6.0.2+dfsg-1		Id: 6/4


External booster drive:
https://www.infineon.com/dgdl/Infineon-External_booster_for_Driver_IC-ApplicationNotes-v01_06-EN.pdf?fileId=5546d46146d18cb40146ffb0461d3894
PNP turn-off circuit:
https://www.youtube.com/watch?v=6pp1jj2oDvo
V_IN
Snubber C
Snubber B
R25 4.7R GH_C
1N5819WS D9
Q3 Q5
MMBT5401 Q1
H15 Phase_C_Pad
Only reserve room for 2.2nF cap
SH_C
R26 4.7R GL_C
1N5819WS D10
Q4 Q6
MMBT5401 Q2
10R R32 10R R34
4.7n C43
C44 4.7n
R33 R35 10R 10R
GND
R38 4.7R GH_B
1N5819WS D11
Q9 Q11
MMBT5401 Q7
H16 Phase_B_Pad
SH_B
R39 4.7R GL_B
1N5819WS D12
Q10 Q12
MMBT5401 Q8
10R R46 10R R48
4.7n C56
C57 4.7n
R47 R49 10R 10R
R51 4.7R GH_A
1N5819WS D13
Q15 Q17
MMBT5401 Q13
H17 Phase_A_Pad
SH_A
R52 4.7R GL_A
1N5819WS D14
Q16 Q18
MMBT5401 Q14
100V 4.7u C37 C38 C39 C40 C41 C42 C
C50 C51 C52 C53 C54 C55
C62 C63 C64 C65 C66 C67
VCC
U9 MS8311
C33 2.2u C34 100n CURR_C R24 150R C35 1n R27 30k R28 62k R29 1k R30 1k C36 100p NT1 NetTie_2 NT2 NetTie_2 R31 0.25mR ASR_M_3-0.25F
U10 MS8311
C45 2.2u C46 100n CURR_B R36 150R C47 1n R40 30k R42 62k R43 1k R44 1k C49 100p NT3 NetTie_2 NT4 NetTie_2 R45 0.25mR
U11 MS8311
C58 2.2u C59 100n CURR_A R50 150R C60 1n R53 30k R54 62k R55 1k R56 1k C61 100p NT5 NetTie_2 NT6 NetTie_2 R57 0.25mR
Op-Amp, Input-to-Output Coupling
To minimize capacitive coupling, the input and output signal traces should not be in parallel. This helps reduce unwanted positive feedback.
TEMP
VCC R37 NTC 10k R41 10k GND
C48 2.2u
Vplus = (Vref-V1) * (R2 / R1 + R2) + V1
Vout = Vplus*(1 + (R4 / R3)) - V2*(R4 / R3)
Calculate cut-off freq of low pass filter, pg 3:
https://www.st.com/resource/en/application_note/an4304-how-to-filter-the-input-of-a-highside-current-sensing-stmicroelectronics.pdf
Current sensing:
https://www.ti.com/lit/eb/slyy154a/slyy154a.pdf?ts=1678787132262&ref_url=https%253A%252F%252Fwww.startpage.com%252F
pg 4, pg 15
Jens Overby
Sheet: /power/
File: power.kicad_sch
Title: FOC KING
Size: A4 Date:
KiCad E.D.A. kicad 6.0.2+dfsg-1
Rev:
Id: 7/4


U14
STM32F405RGT6
CURRENT_3
CURRENT_2
CURRENT_1
ADC_TEMP
H1
H2
H3
USB_D−
USB_D+
SERVO_MOTORTEMP
LED_GREEN
LED_RED
CAN_RX
CAN_TX
HALL_1
HALL_2
HALL_3
AN_IN
VOLTAGE_3
VOLTAGE_2
VOLTAGE_1
PA0(ADC123_IN0/WKUP)
PA1(ADC123_IN1)
PA2(ADC123_IN2)
PA3(ADC123_IN3)
PA4(ADC12_IN4/DAC1_OUT)
PA5(ADC12_IN5/DAC2_OUT)
PA6(ADC12_IN6)
PA7(ADC12_IN7)
PA8
PA9(OTG_FS_VBUS)
PA10
PA11
PA12
PB0(ADC12_IN8)
PB1(ADC12_IN9)
PB5
PB6
PB7
PB8
PB9
PB10
PB11
PB12
PB13(OTG_HS_VBUS)
PB14
PB15
PC0(ADC123_IN10)
PC1(ADC123_IN11)
PC2(ADC123_IN12)
PC3(ADC123_IN13)
PC4(ADC12_IN14)
PC5(ADC12_IN15)
PC6
PC7
PC8
PC9
PC10
PC11
PC12
PC13_(RTC_AF1)
PD2
PC14−OSC32_IN
PC15−OSC32_OUT
PH0−OSC_IN
PH1−OSC_OUT
BOOT0(VPP)
PB2−BOOT1
NRST
PA13(JTMS−SWDIO)
PA14(JTCK−SWCLK)
PA15(JTDI)
PB3(JTDO/TRACESWO)
PB4(NJTRST)
VDD
VSS
VBAT
VDDA
VSSA
VCAP1
VCAP2
PH1
PH0
PB2
PA15
PB3
PB4
P13
SWD
VCC
GND
3.3VA
PWR_FLAG
C74 2.2u
C75 2.2u
DECOUPLING
C76 100n
C77 100n
C79 100n
C82 100n
L1 30n
C78 1u
C80 10n
C84 100n
C85 10u
Bypass, place next to VDD pins
8MHz Crystal Resonator, X50328MSB2GI
Y1
C81 12p
C83 12p
LEDs
LED_RED
LED_GREEN
+5V
D15 RED
D16 GRN
D17 BLU
R64 10k
R65 10k
R66 20k
USB−C
J4
TYPE−C−31−M−12
R62 5.1k
R63 5.1k
USB_D+
USB_D−
SW2A
SW_DPDT_x2
LQFP64
TIM3_CH4 is configured for pin PB1 pin 27
according to stm32f405 datasheet
https://www.st.com/en/microcontrollers−microprocessors/stm32f405rg.html
Changes:
Xtal caps from 18pF to 12pF
Separate the two LEDs from the single resistor
CAN spike protection
RC between GND and pb12 to stop false trips
PC12−>PA15 to drive LED
Increased functionality of several header pins
Jens Overby
Sheet: /mcu/
File: mcu.kicad_sch
Title: FOC KING
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 6.0.2+dfsg−1
Id: 9/4