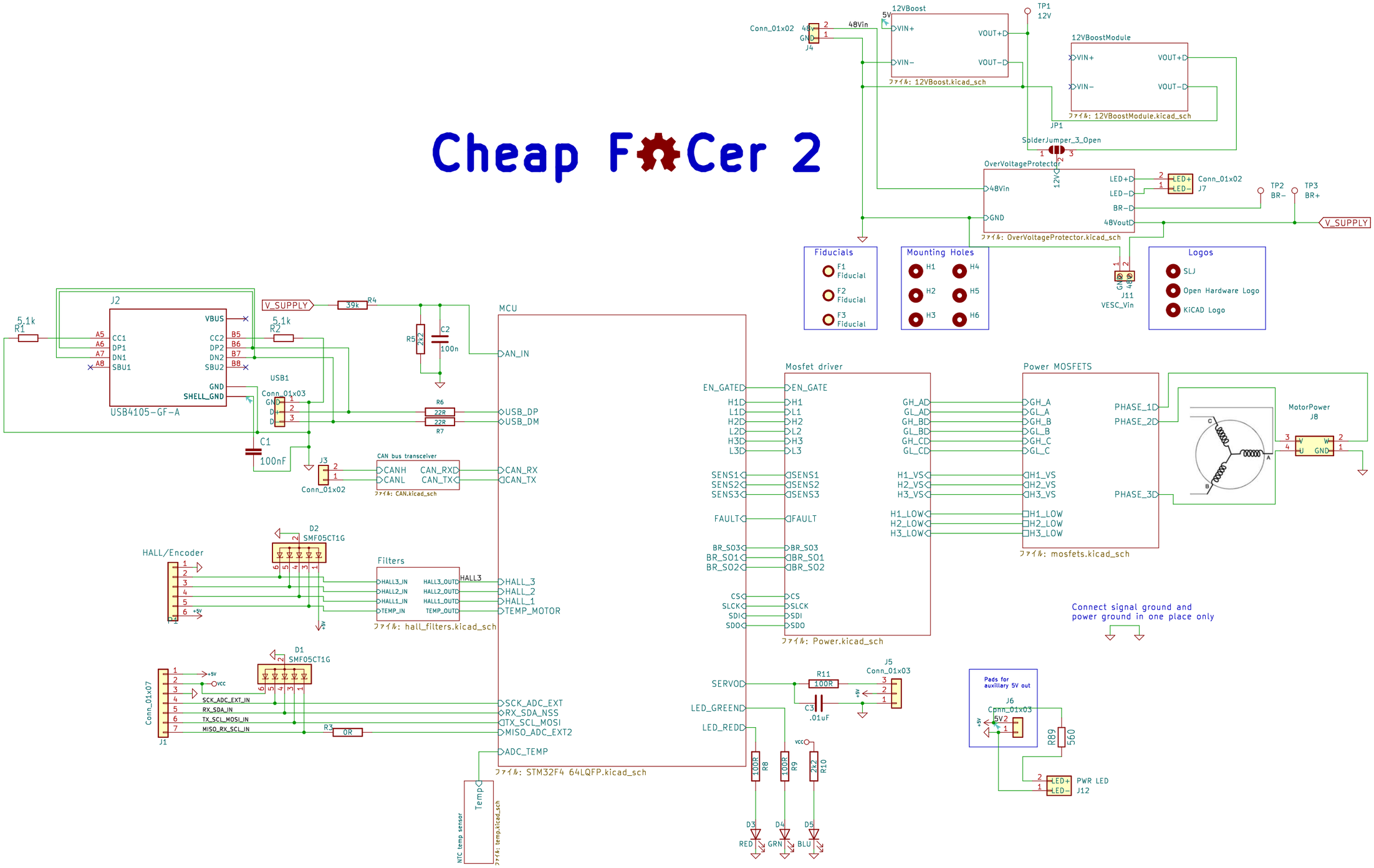
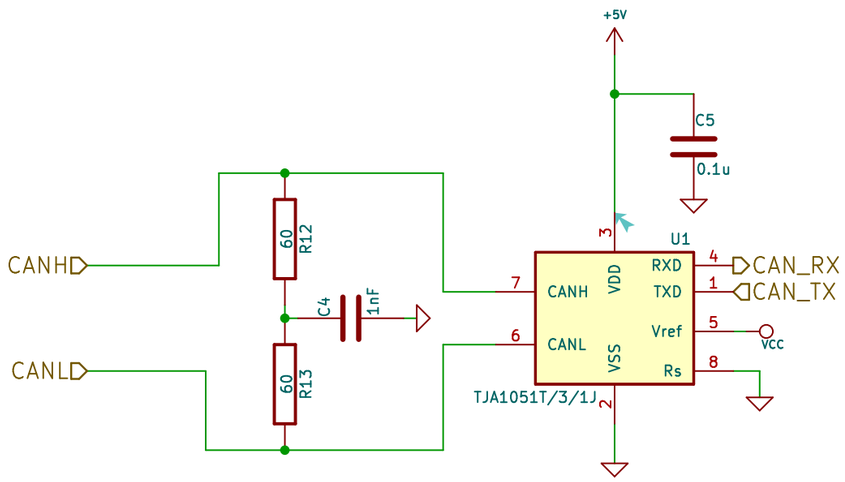
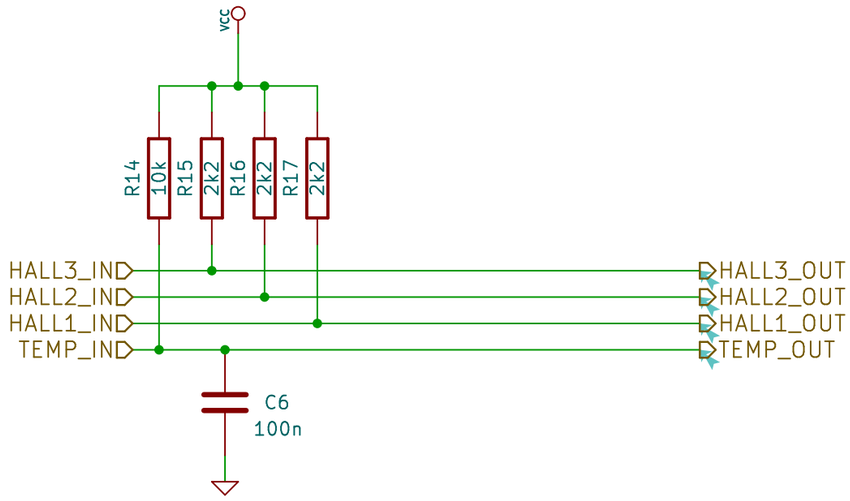
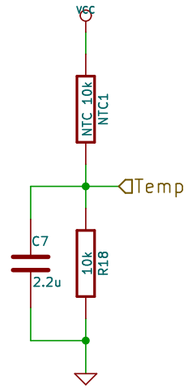
Cheap FOCer 2




+5V
C5
0.1u
U1
3
CANH
60
R12
C4
1nF
CANL
60
R13
7
6
CANH
CANL
VDD
VSS
RXD
TXD
Vref
Rs
4
1
5
8
CAN_RX
CAN_TX
Vcc
TJA1051T/3/1J
2

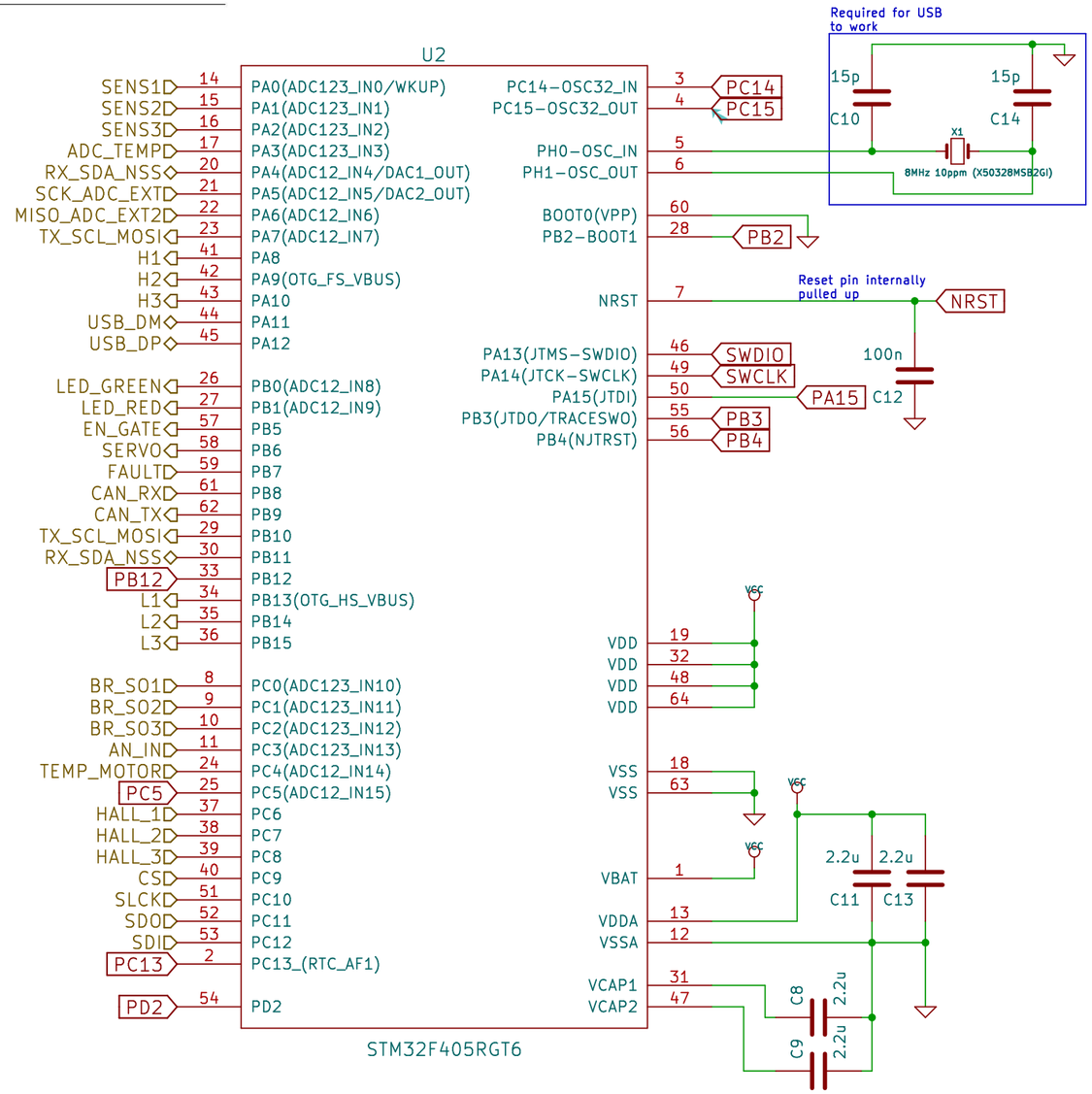

vcc
R14
10k
R15
2k2
R16
2k2
R17
2k2
HALL3_IN
HALL2_IN
HALL1_IN
TEMP_IN
HALL3_OUT
HALL2_OUT
HALL1_OUT
TEMP_OUT
C6
100n

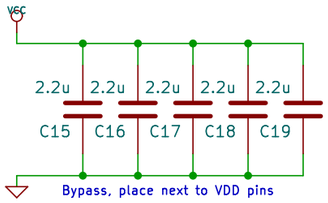

VCC
NTC_10k
NTC1
Temp
C7
2.2u
10k
R18

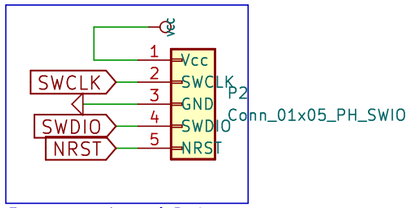
life.augmented

STM32F405xx
STM32F407xx

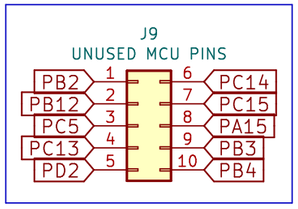
ARM Cortex-M4 32b MCU+FPU, 210DMIPS, up to 1MB Flash/192+4KB RAM, USB OTG HS/FS, Ethernet, 17 TIMs, 3 ADCs, 15 comm. interfaces & camera



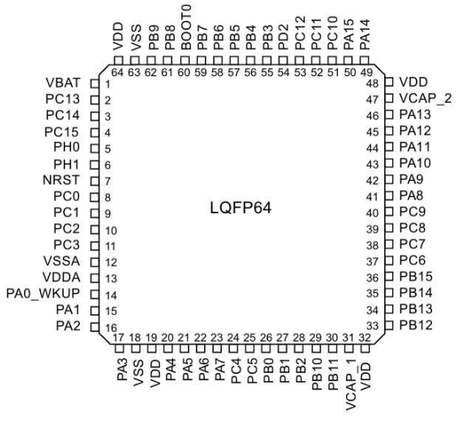


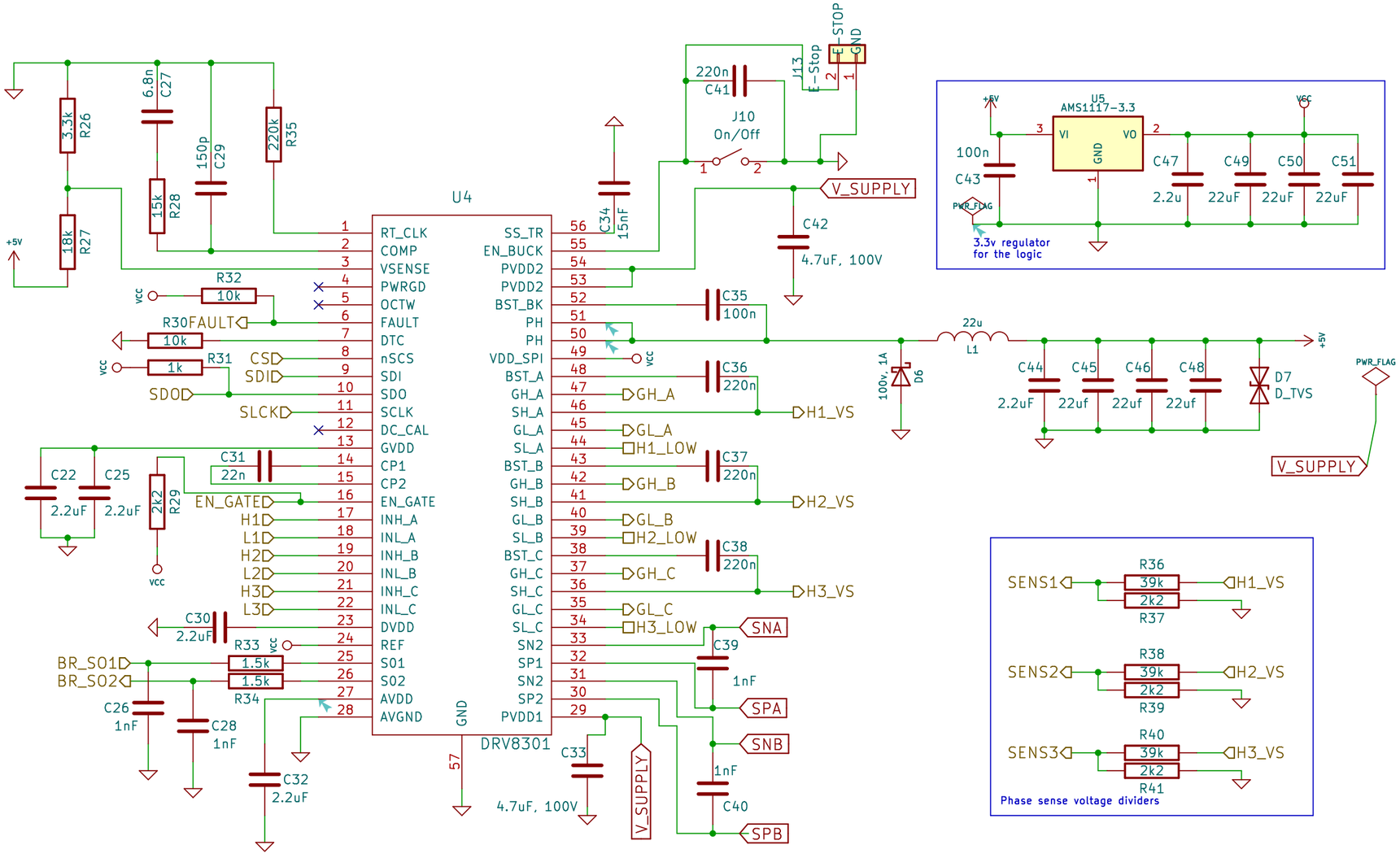


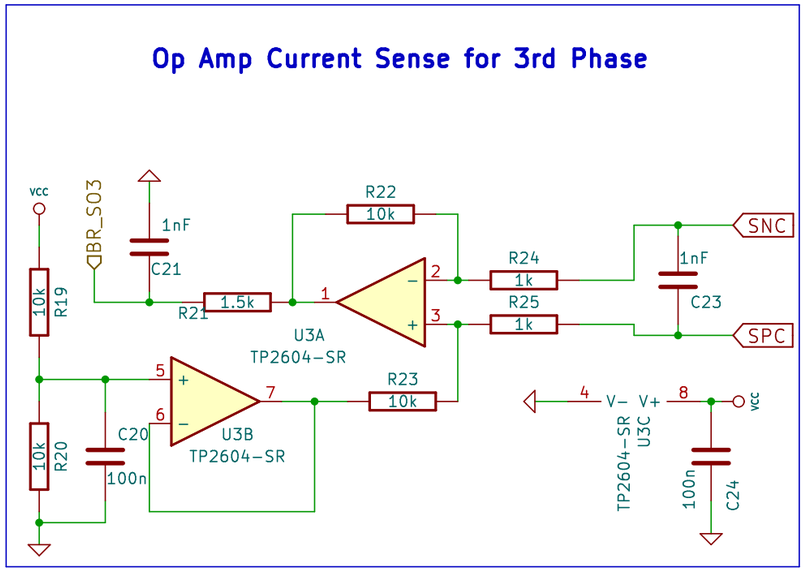
Programming / Debug connector



Unused MCU Pins

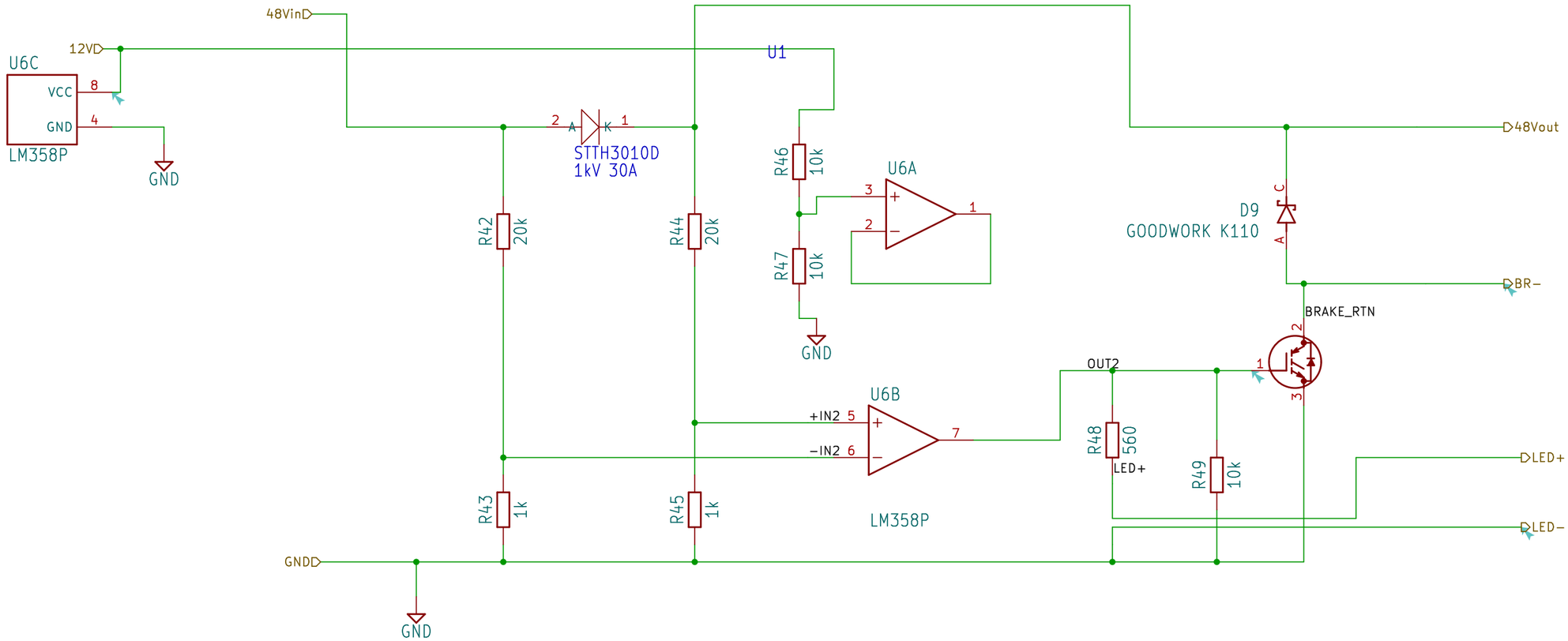



U4
RT_CLK
COMP
VSENSE
PWRGD
OCTW
FAULT
DTC
nSCS
SDI
SDO
SCLK
DC_CAL
GVDD
CP1
CP2
EN_GATE
INH_A
INL_A
INH_B
INL_B
INH_C
INL_C
DVDD
REF
S01
S02
AVDD
AVGND
SS_TR
EN_BUCK
PVDD2
PVDD2
BST_BK
PH
PH
VDD_SPI
BST_A
GH_A
SH_A
GL_A
SL_A
BST_B
GH_B
SH_B
GL_B
SL_B
BST_C
GH_C
SH_C
GL_C
SL_C
SN2
SP1
SN2
SP2
PVDD1
GND
DRV8301
R26 3.3k
C27 6.8n
C29 150p
R35 220k
R28 15k
R27 18k
+5V
R32 10k
R30 10k
FAULT
R31 1k
CS
SDI
SDO
SLCK
C22 2.2uF
C25 2.2uF
C31 22n
R29 2k2
EN_GATE
H1
L1
H2
L2
H3
L3
C30 2.2uF
R33 1.5k
R34 1.5k
BR_SO1
BR_SO2
C26 1nF
C28 1nF
C32 2.2uF
C34 15nF
C41 220n
J13 E-Stop
E-STOP
GND
J10 On/Off
V_SUPPLY
C42 4.7uF, 100V
C35 100n
C36 220n
GH_A
H1_VS
GL_A
H1_LOW
C37 220n
GH_B
H2_VS
GL_B
H2_LOW
C38 220n
GH_C
H3_VS
GL_C
H3_LOW
SNA
C39 1nF
SPA
SNB
C40 1nF
SPB
C33 4.7uF, 100V
V_SUPPLY
57
U5
AMS1117-3.3
VI
VO
GND
100n C43
PWR_FLAG
3.3v regulator for the logic
C47 2.2u
C49 22uF
C50 22uF
C51 22uF
VCC
22u L1
100v, 1A D6
C44 2.2uF
C45 22uf
C46 22uf
C48 22uf
D7 D_TVS
PWR_FLAG
V_SUPPLY
R36 39k
R37 2k2
SENS1
H1_VS
R38 39k
R39 2k2
SENS2
H2_VS
R40 39k
R41 2k2
SENS3
H3_VS
Phase sense voltage dividers

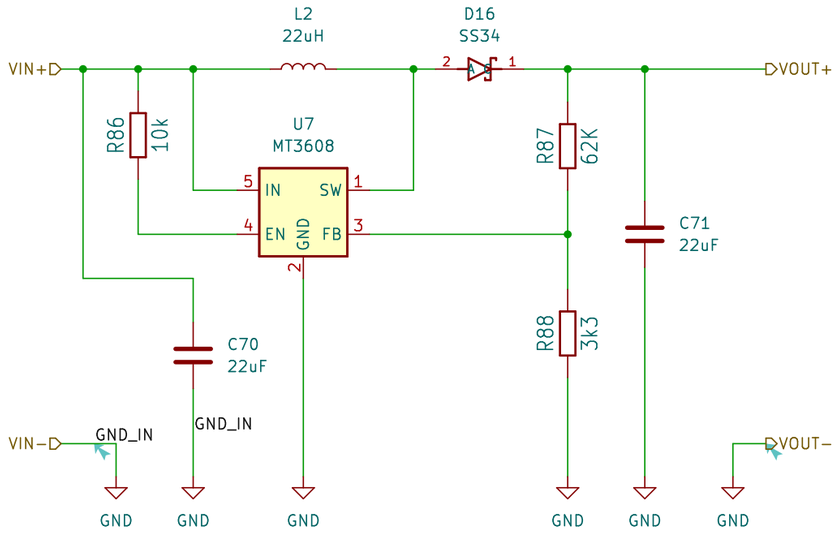

Op Amp Current Sense for 3rd Phase
vcc
BR_SO3
1nF C21
R22 10k
R21 1.5k
U3A
TP2604-SR
R24 1k
R25 1k
1nF C23
SNC
SPC
R23 10k
U3B
TP2604-SR
R19 10k
R20 10k
C20 100n
4 V- V+ 8
TP2604-SR U3C
100n C24

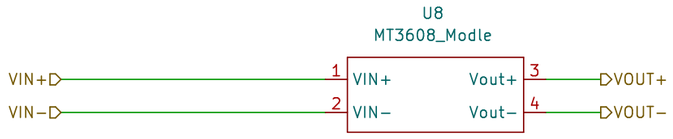
Opamp Power

Over Voltage Protection Circuit



V_SUPPLY
C58
10uF, 100V
C61
10uF, 100V
C62
10uF, 100V
10uF 100V ceramic caps placed in power stage
330u, 63V
C54
330u, 63V
C57
330u, 63V
C65
Choice of electrolytic capcitors is important.
10,000 hour lifetime, low-ESR, low-impedance,
and high ripple current ratings are strongly advised.
V_SUPPLY
GH_A
R53
4.7R
R51
4.7R
Q3
Q_PNP
Q4
NCEP60T20
D11
C52
2.2nF
4.7k
R54
PHASE_1
H1_VS
10R
R58
10R
R60
4.7nF, 100V
C55
GH_B
R64
4.7R
R62
4.7R
Q6
Q_PNP
Q8
NCEP60T20
D12
C59
2.2nF
R66
4.7k
PHASE_2
H2_VS
10R
R70
10R
R72
4.7nF, 100V
C63
GH_C
R76
4.7R
R74
4.7R
Q10
Q_PNP
Q12
NCEP60T20
D14
C66
1nF
4.7k
R78
PHASE_3
H3_VS
10R
R82
10R
R84
4.7nF, 100V
C68
GL_A
R52
4.7R
R50
4.7R
Q2
Q_PNP
Q5
NCEP60T20
D10
C53
2.2nF
R55
4.7k
H1_LOW
C56
4.7nF, 100V
R59
10R
R61
10R
SNA
NT1
Net-Tie_2
R56
0.01R
R57
0.01R
SPA
NT2
Net-Tie_2
GL_B
R65
4.7R
R63
4.7R
Q7
Q_PNP
Q9
NCEP60T20
D13
C60
2.2nF
R67
4.7k
H2_LOW
C64
4.7nF, 100V
R71
10R
R73
10R
SNB
NT3
Net-Tie_2
R68
0.01R
R69
0.01R
SPB
NT4
Net-Tie_2
GL_C
R77
4.7R
R75
4.7R
Q11
Q_PNP
Q13
NCEP60T20
D15
C67
1nF
R79
4.7k
H3_LOW
C69
4.7nF, 100V
R83
10R
R85
10R
SNC
NT5
Net-Tie_2
R80
0.01R
R81
0.01R
SPC
NT6
Net-Tie_2
Choice of MOSFET is important.
60V mininmum Vds and 2.5ohm max Rds(on)
are strongly advised. The lower the Rds(on),
the less energy is wasted to heat dissipation.


L2
22uH
D16
SS34
VIN+
VOUT+
R86
10k
U7
MT3608
IN
SW
EN
GND
FB
R87
62K
C71
22uF
C70
22uF
R88
3k3
GND_IN
GND_IN
VIN-
VOUT-
GND
GND
GND
GND
GND
GND


U8
MT3608_Modle
VIN+
VIN−
1
2
VIN+
VIN−
Vout+
Vout−
3
4
VOUT+
VOUT−