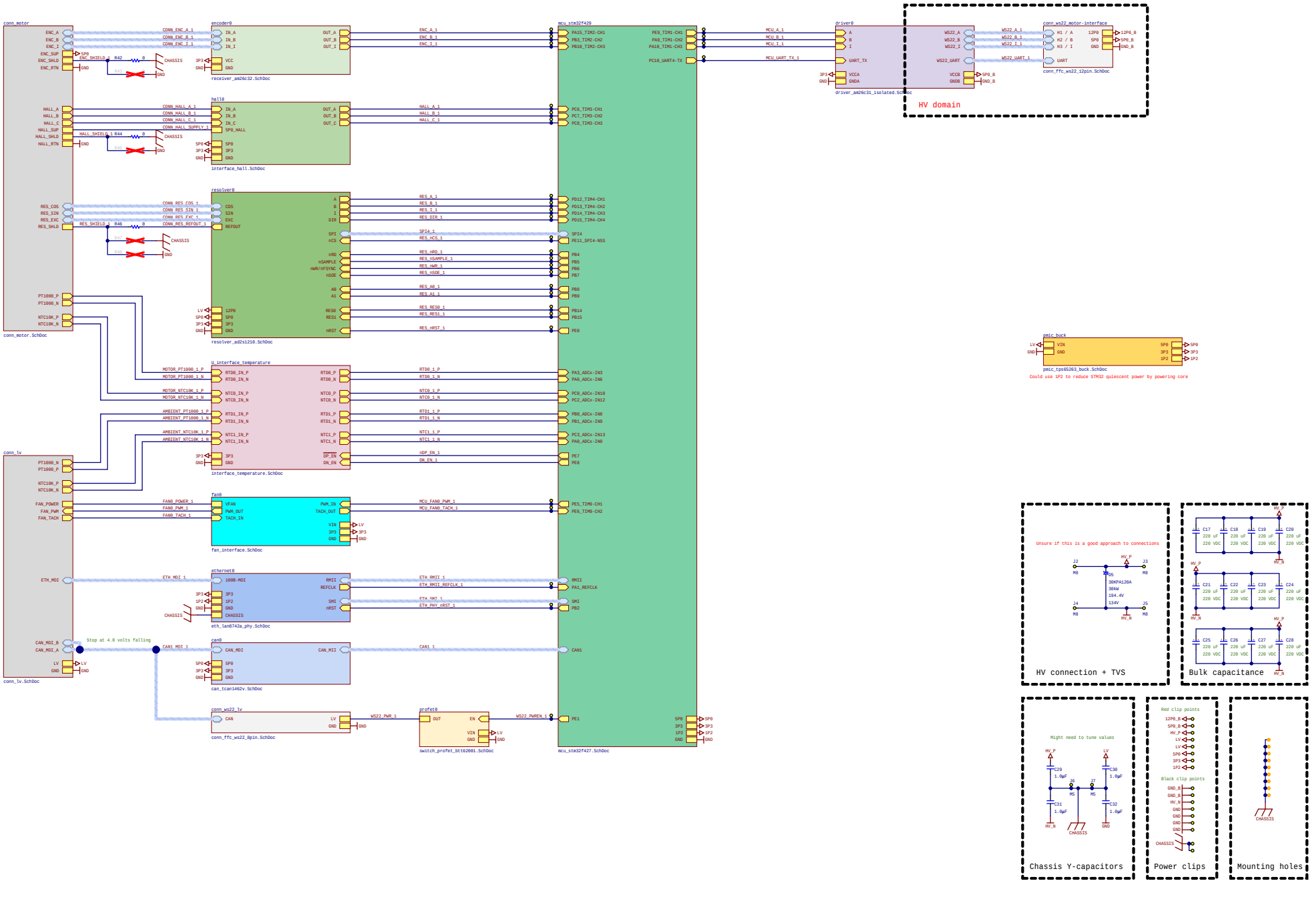
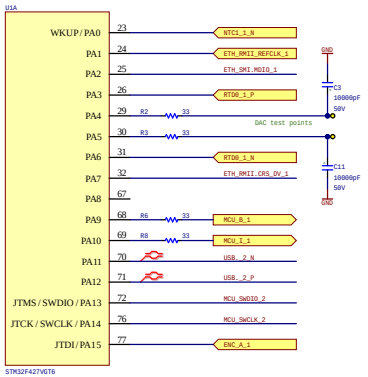
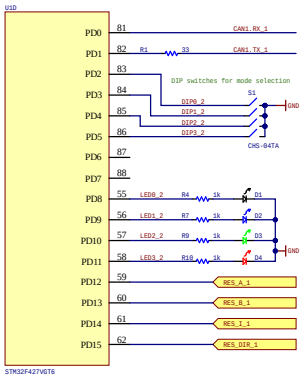
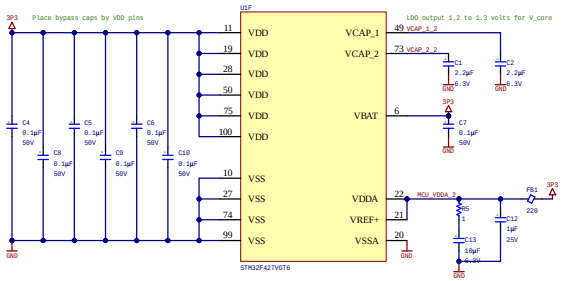
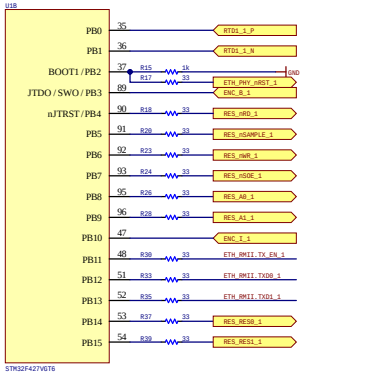
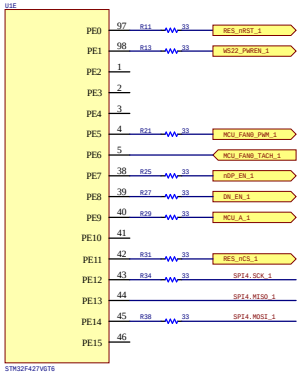

conn_motor
encoder0
receiver_am26c32.SchDoc
hall0
interface_hall.SchDoc
resolver0
resolver_ad2s1210.SchDoc
U_interface_temperature
interface_temperature.SchDoc
fan0
fan_interface.SchDoc
ethernet0
eth_lan8742a_phy.SchDoc
can0
can_tcan1462v.SchDoc
conn_ws22_lv
conn_ffc_ws22_8pin.SchDoc
profet0
switch_profet_btt6200l.SchDoc
conn_motor.SchDoc
conn_lv
conn_lv.SchDoc
mcu_stm32f429
mcu_stm32f427.SchDoc
driver0
driver_am26c31_isolated.SchDoc
conn_ws22_motor-interface
conn_ffc_ws22_12pin.SchDoc
HV domain
pmic_buck
pmic_tps65263_buck.SchDoc
Could use 1P2 to reduce STM32 quiescent power by powering core
Stop at 4.0 volts falling
Unsure if this is a good approach to connections
HV connection + TVS
Bulk capacitance
Might need to tune values
Chassis Y-capacitors
Red clip points
Black clip points
Power clips
Mounting holes

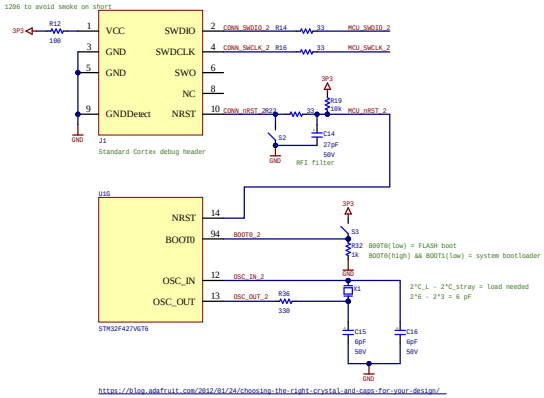

U1A
WKUP / PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PA8
PA9
PA10
PA11
PA12
JTMS / SWDIO / PA13
JTCK / SWCLK / PA14
JTDI / PA15
NTC1_1_N
ETH_RMII_REFCLK_1
ETH_SMI_MDIO_1
RTD0_1_P
RTD0_1_N
ETH_RMII_CRS_DV_1
MCU_B_1
MCU_I_1
USB_ _2_N
USB_ _2_P
MCU_SWDIO_2
MCU_SWCLK_2
ENC_A_1
GND
C3
10000pF
50V
C11
10000pF
50V
DAC test points
R2
R3
R6
R8
33
STM32F427VGT6

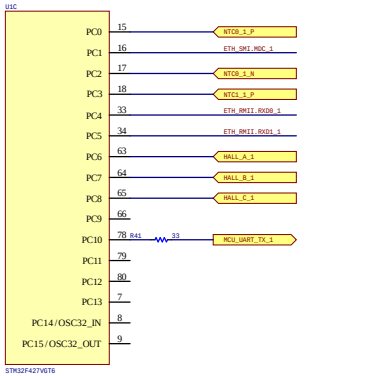

U1D
PD0
PD1
PD2
PD3
PD4
PD5
PD6
PD7
PD8
PD9
PD10
PD11
PD12
PD13
PD14
PD15
CAN1_RX_1
CAN1_TX_1
R1
33
DIP switches for mode selection
DIP0_2
DIP1_2
DIP2_2
DIP3_2
S1
CHS-04TA
GND
LED0_2
LED1_2
LED2_2
LED3_2
R4
R7
R9
R10
1k
D1
D2
D3
D4
RES_A_1
RES_B_1
RES_I_1
RES_DIR_1
STM32F427VGT6

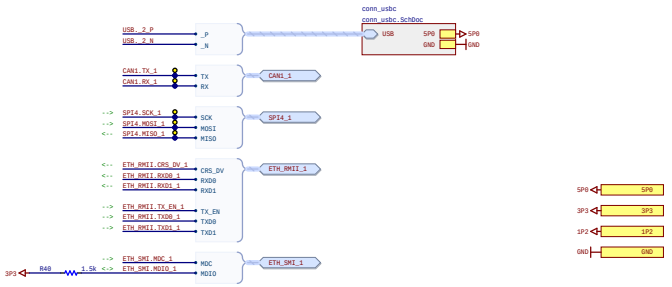

3P3
Place bypass caps by VDD pins
U1F
VDD
VSS
VCAP_1
VCAP_2
VBAT
VDDA
VREF+
VSSA
LDO output 1.2 to 1.3 volts for V_core
VCAP_1_2
VCAP_2_2
C1
2.2µF
6.3V
C2
2.2µF
6.3V
C4
C5
C6
C7
C8
C9
C10
0.1µF
50V
MCU_VDDA_2
R5
1
C12
1µF
25V
C13
10µF
6.3V
FB1
220
STM32F427VGT6


U1B
PB0
PB1
BOOT1 / PB2
JTDO / SWO / PB3
nJTRST / PB4
PB5
PB6
PB7
PB8
PB9
PB10
PB11
PB12
PB13
PB14
PB15
RTD1_1_P
RTD1_1_N
R15
R17
1k
33
ETH_PHY_nRST_1
ENC_B_1
R18
R20
R23
R24
R26
R28
R30
R33
R35
R37
R39
RES_nRD_1
RES_nSAMPLE_1
RES_nWR_1
RES_nSOE_1
RES_A0_1
RES_A1_1
ENC_I_1
ETH_RMII_TX_EN_1
ETH_RMII_TXD0_1
ETH_RMII_TXD1_1
RES_RES0_1
RES_RES1_1
GND
STM32F427VGT6


U1E
PE0
PE1
PE2
PE3
PE4
PE5
PE6
PE7
PE8
PE9
PE10
PE11
PE12
PE13
PE14
PE15
R11
R13
R21
R25
R27
R29
R31
R34
R38
33
RES_nRST_1
WS22_PWREN_1
MCU_FAN0_PWM_1
MCU_FAN0_TACH_1
nOP_EN_1
OW_EN_1
MCU_A_1
RES_nCS_1
SPI4.SCK_1
SPI4.MISO_1
SPI4.MOSI_1
STM32F427VGT6


1206 to avoid smoke on short
3P3
R12
100
J1
Standard Cortex debug header
VCC
GND
GNDDetect
SWDIO
SWDCLK
SWO
NC
NRST
CONN_SWDIO_2
CONN_SWCLK_2
CONN_nRST_2
R14
R16
R19
10k
MCU_SWDIO_2
MCU_SWCLK_2
MCU_nRST_2
S2
C14
27pF
50V
RFI filter
U1G
NRST
BOOT0
OSC_IN
OSC_OUT
BOOT0_2
OSC_IN_2
OSC_OUT_2
R32
1k
R36
330
X1
C15
6pF
50V
C16
6pF
50V
BOOT0(low) = FLASH boot
BOOT0(high) && BOOT1(low) = system bootloader
2*C_L - 2*C_stray = load needed
2*6 - 2*3 = 6 pF
STM32F427VGT6
https://blog.adafruit.com/2012/01/24/choosing-the-right-crystal-and-caps-for-your-design/


U1C
PC0
PC1
PC2
PC3
PC4
PC5
PC6
PC7
PC8
PC9
PC10
PC11
PC12
PC13
PC14 / OSC32_IN
PC15 / OSC32_OUT
NTC0_1_P
ETH_SMI_MDC_1
NTC0_1_N
NTC1_1_P
ETH_RMII_RXD0_1
ETH_RMII_RXD1_1
HALL_A_1
HALL_B_1
HALL_C_1
R41
33
MCU_UART_TX_1
STM32F427VGT6


conn_usbc
conn_usbc.SchDoc
USB
SP0
GND
USB_ _2_P
USB_ _2_N
CAN1_TX_1
CAN1_RX_1
CAN1_1
SPI4.SCK_1
SPI4.MOSI_1
SPI4.MISO_1
SPI4_1
ETH_RMII.CRS_DV_1
ETH_RMII.RXD0_1
ETH_RMII.RXD1_1
ETH_RMII.TX_EN_1
ETH_RMII.TXD0_1
ETH_RMII.TXD1_1
ETH_RMII_1
ETH_SMI.MDC_1
ETH_SMI.MDIO_1
ETH_SMI_1
R40
1.5k
3P3
1P2

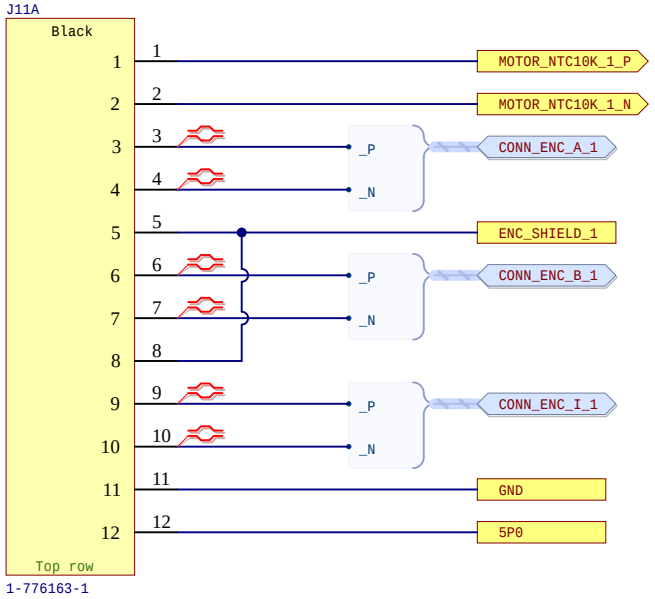
Use with 22-24 AWG wire

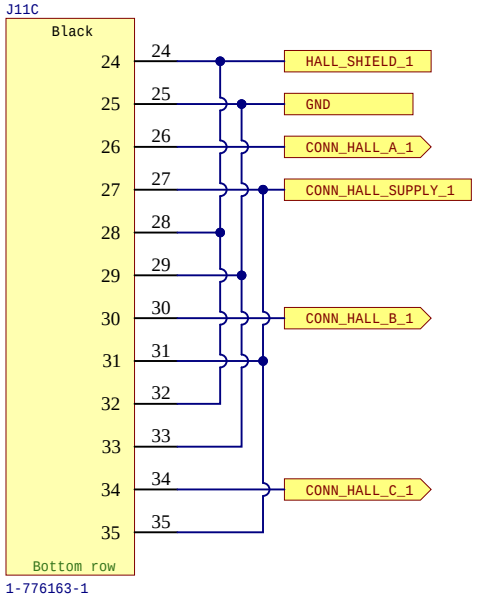
Mating crimps: 1-770520-1
Mating connector: 2371885-1
Sealing plugs: 776364-1
CPA: 2373965-1
Backshell: 2389807-1

Assumes 10k B = 3380K NTC thermistor.

Assumes 5-volt differential encoder.

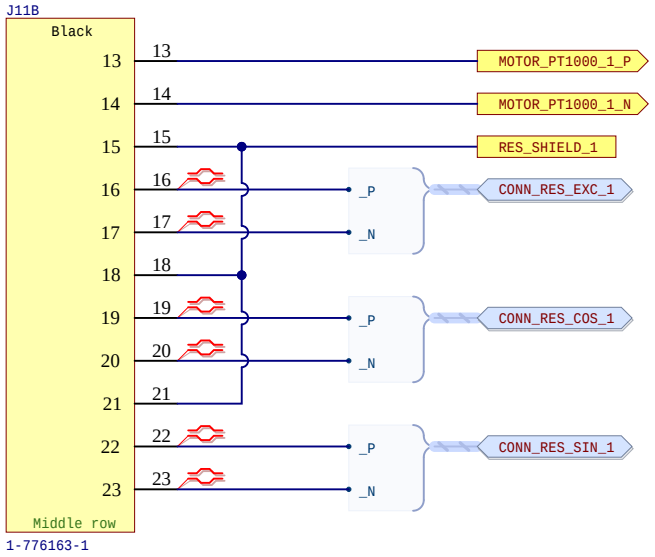
This board connects the shield to the CHASSIS net by default, but offers a 0R stuffing option to connect it to GND instead.





Assumes PT1000 RTD temperature sensor.

This board connects the shield to the REFOUT of the AD2S1200 by default, but offers 0R stuffing options to connect it to CHASSIS or GND nets instead.



Assumes 5-volt Hall effect sensors. Pull-ups are provided. The extra supply and return pins enable wiring to individual sensors that may not have bussed bias.

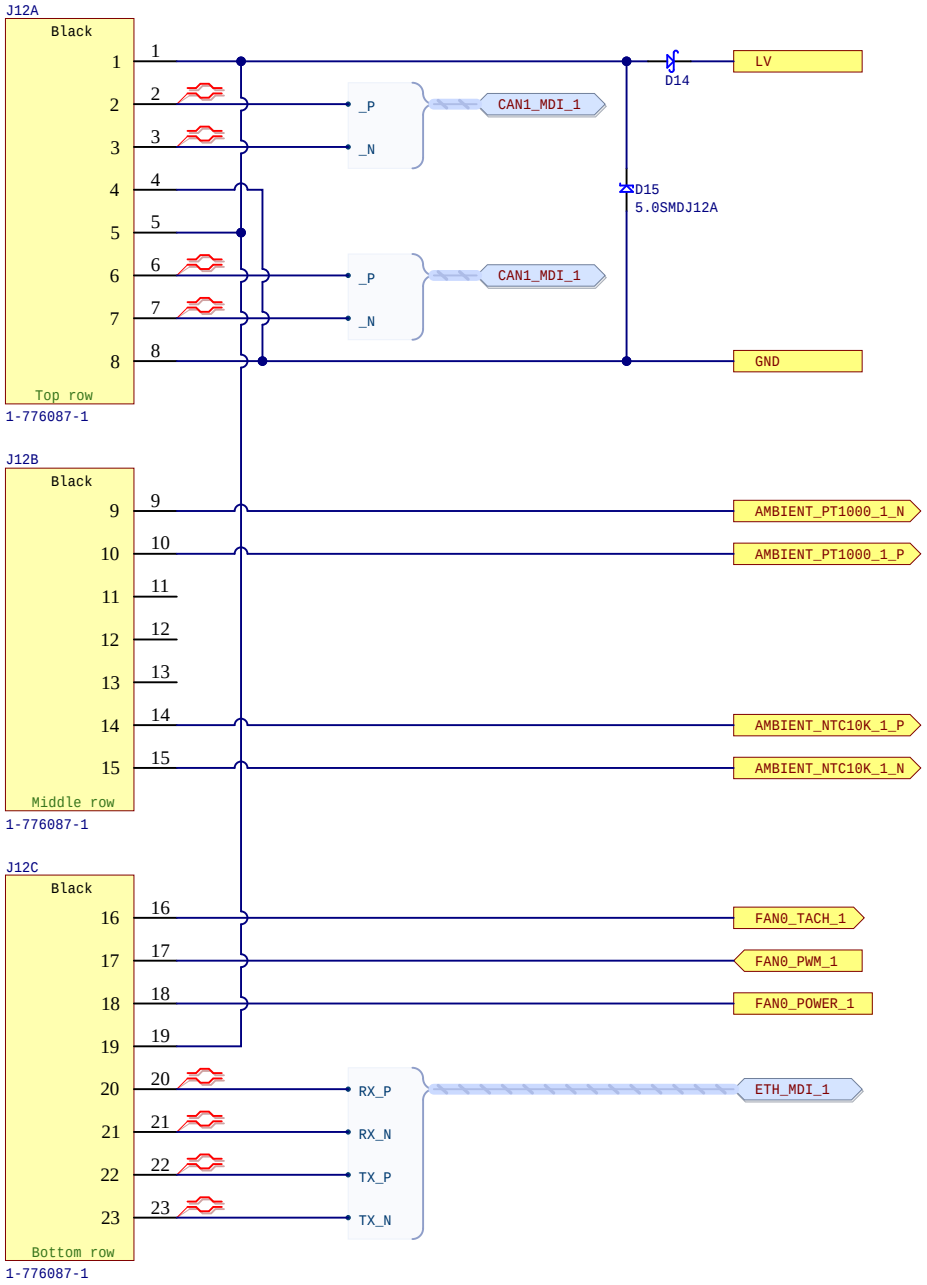
This board connects the shield to the CHASSIS net by default, but offers a 0R stuffing option to connect it to GND instead.

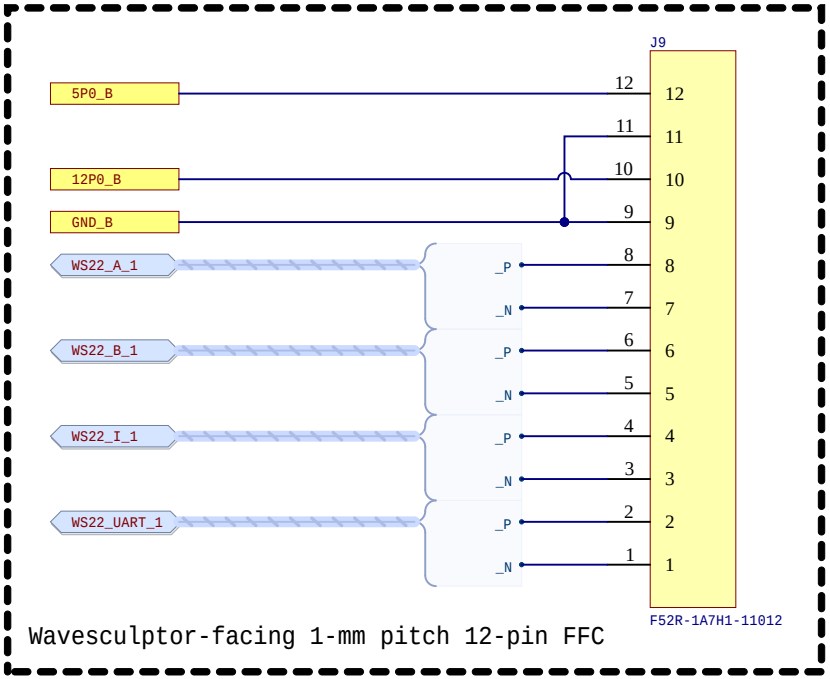
Use with 20-24 AWG wire

Mating crimps 20-22 AWG: 770520-8
Mating crimps 22-24 AWG: 1-770520-1
Mating connector: 2371884-1
Sealing plugs: 776364-1
CPA: 2373965-1
Backshell: 2389806-1

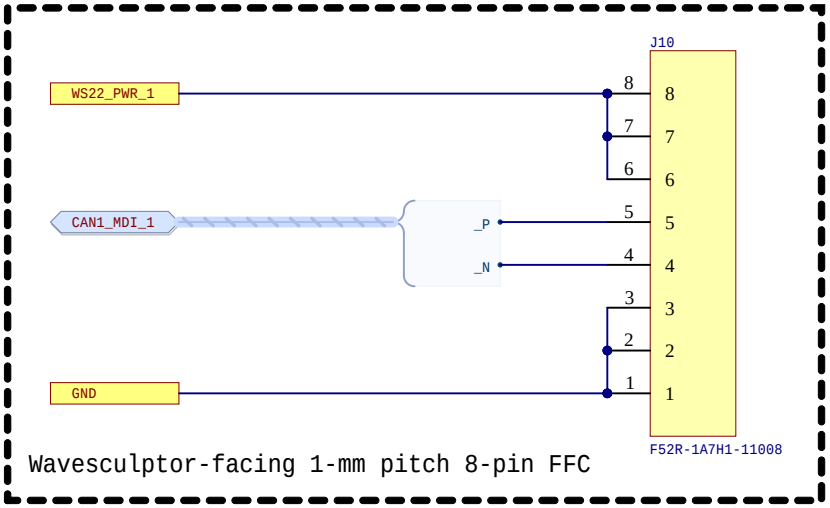
https://www.te.com/commerce/DocumentDelivery/DDEController?Action=srchrtrv&DocNm=ict_ampseal_cat_a4_1-1773979-2_en&DocType=Catalog%20Section&DocLang=English&DocFormat=pdf&PartCntxt=1-776087-1

* Must use 3- or 4-wire PWM-controlled fan. *

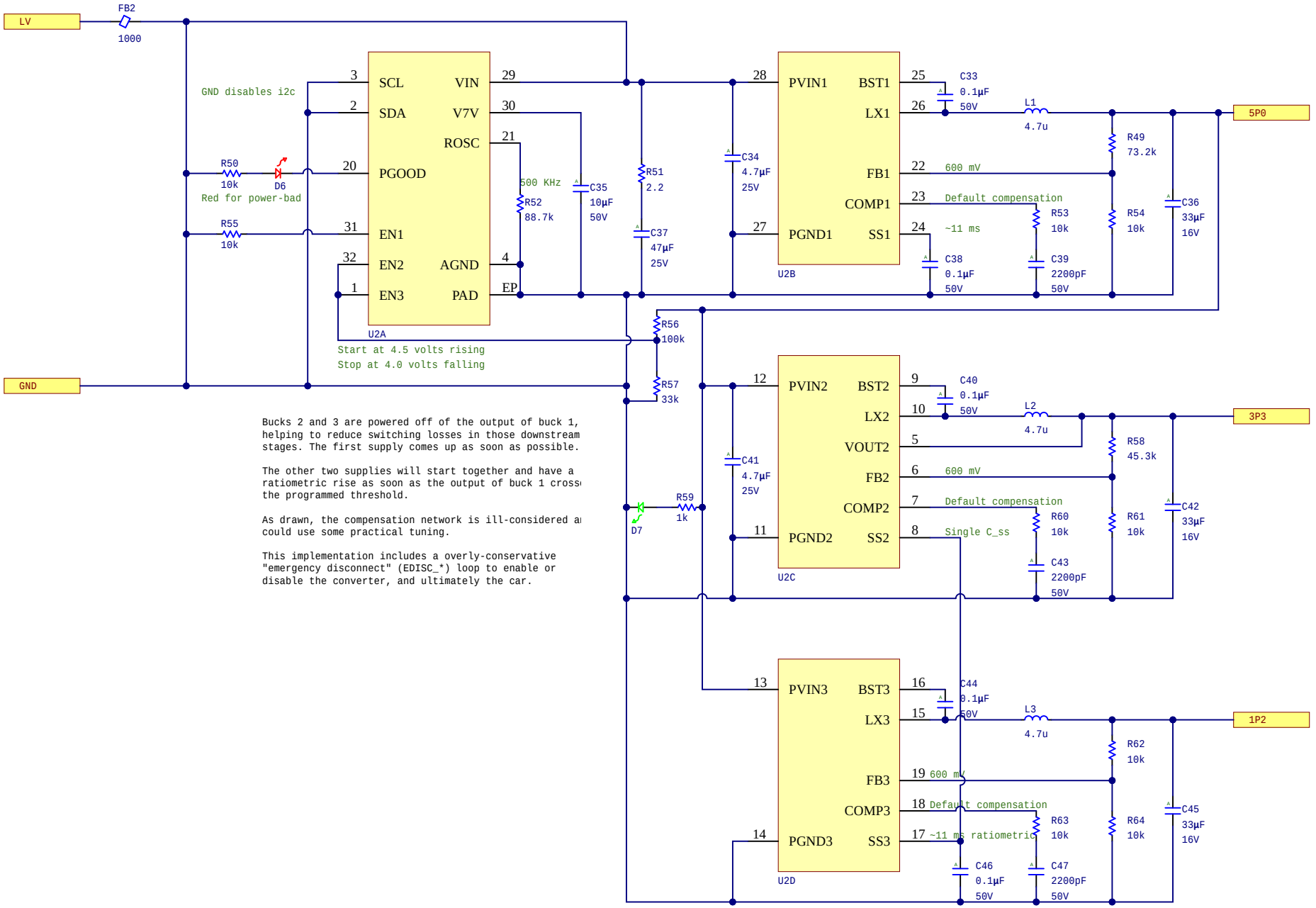




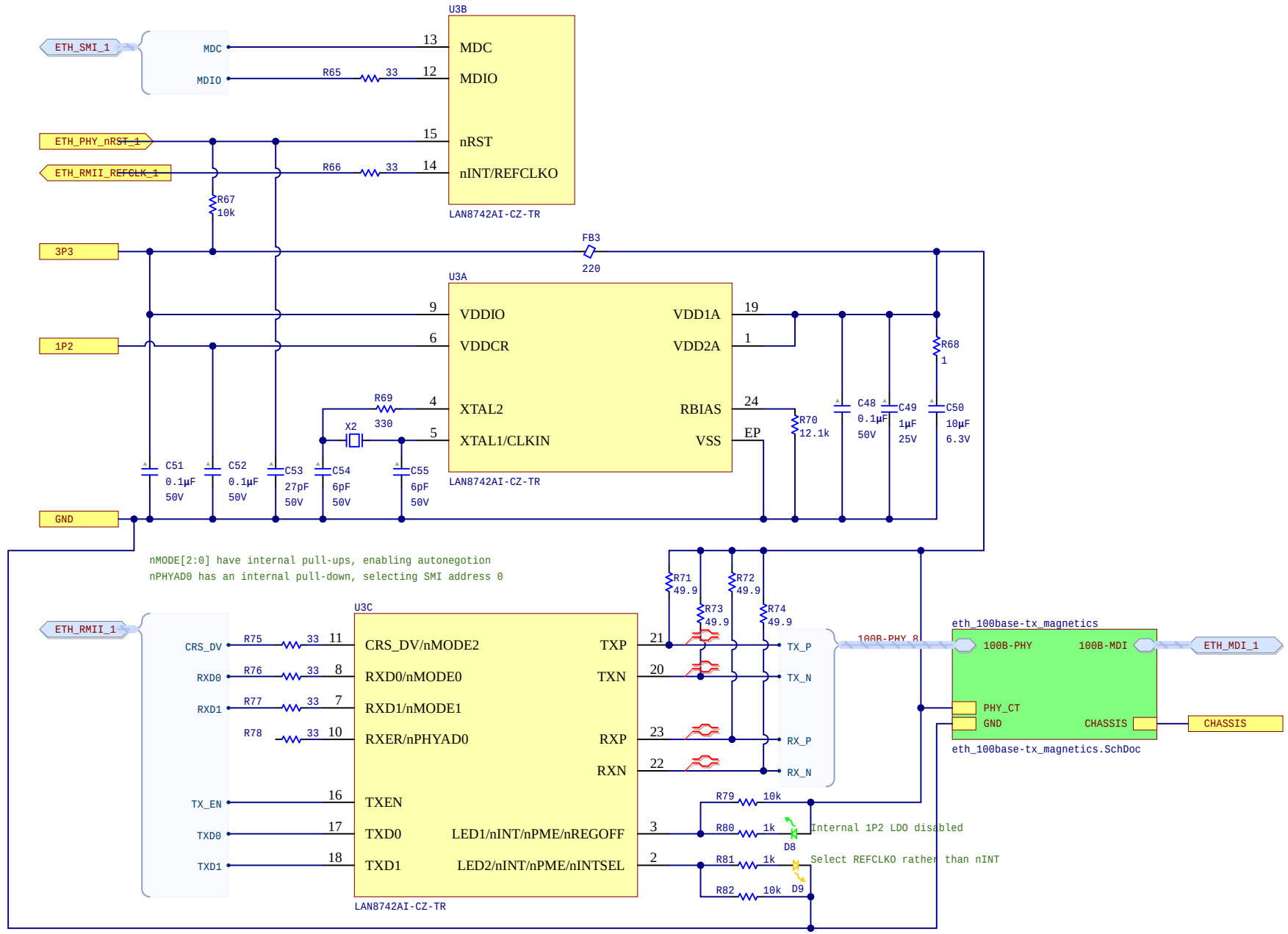
Note that the pin definition here is the mirror image of what is seen on the Wavesculptor 22 logic board. These signals appear to be referenced from the high-voltage domain and should not get connected back to the low voltage domain.



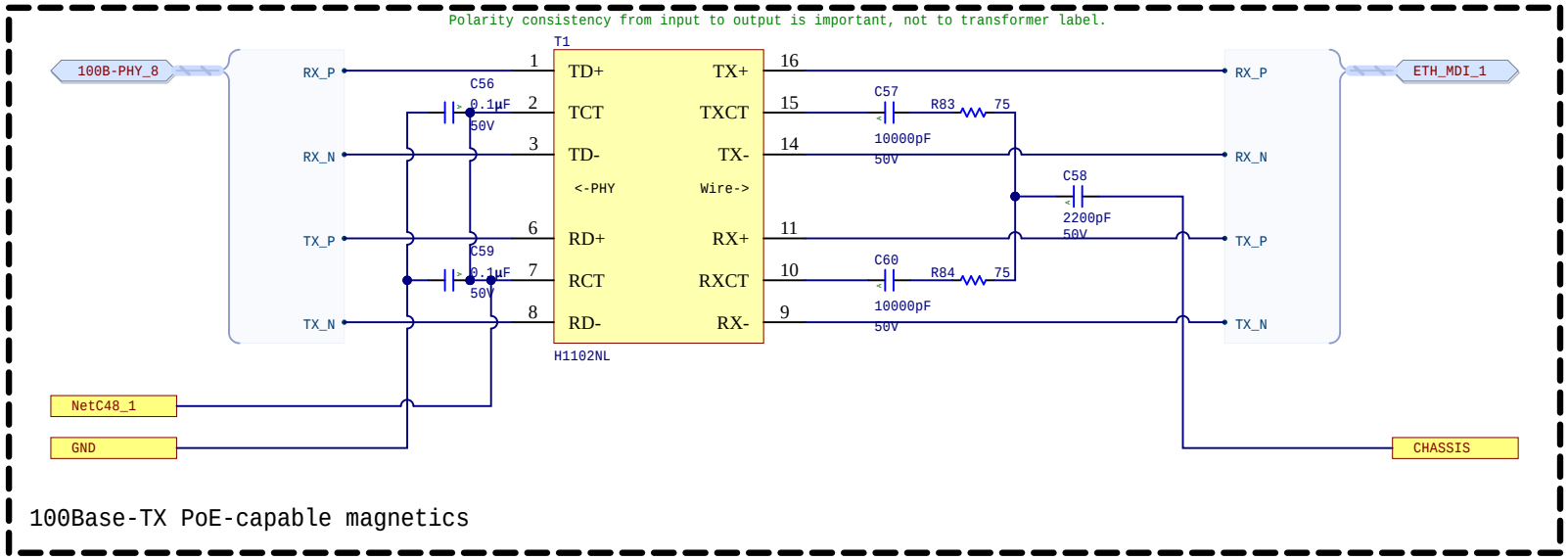
Note that the pin definition here is the mirror image
of what is seen on the Wavesculptor 22 logic board.
These signals are on the LV side of the Wavesculptor 2



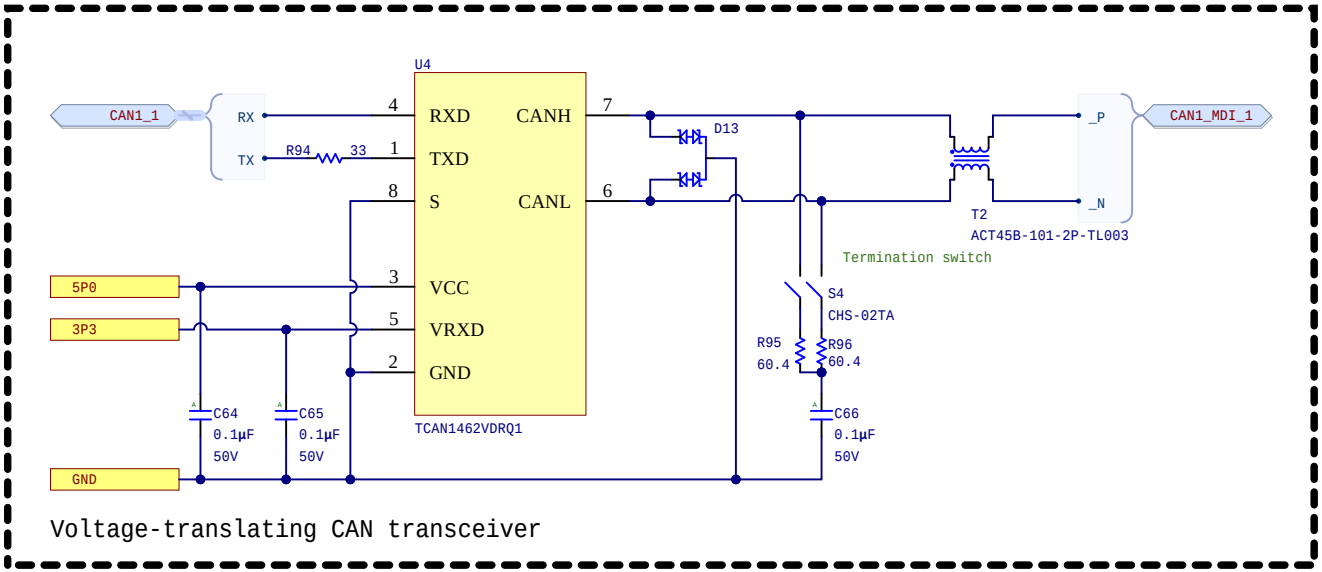
<=18 volt input, 3A/2A/2A triple buck



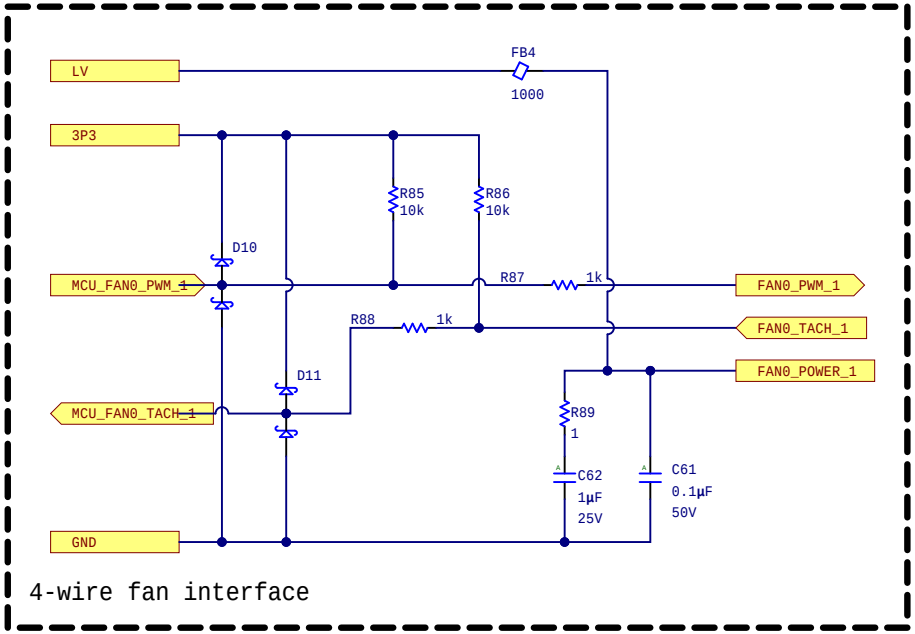
RMII-interface 100Base-TX PHY

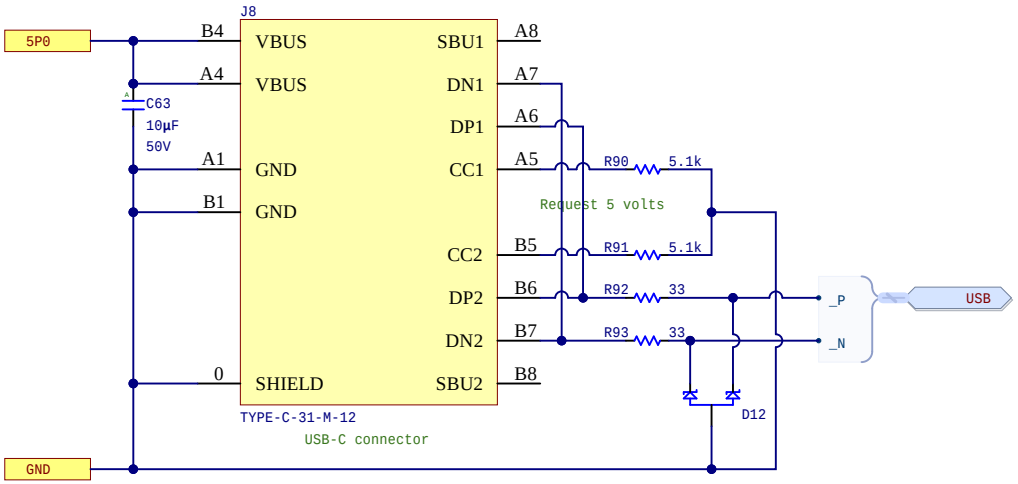


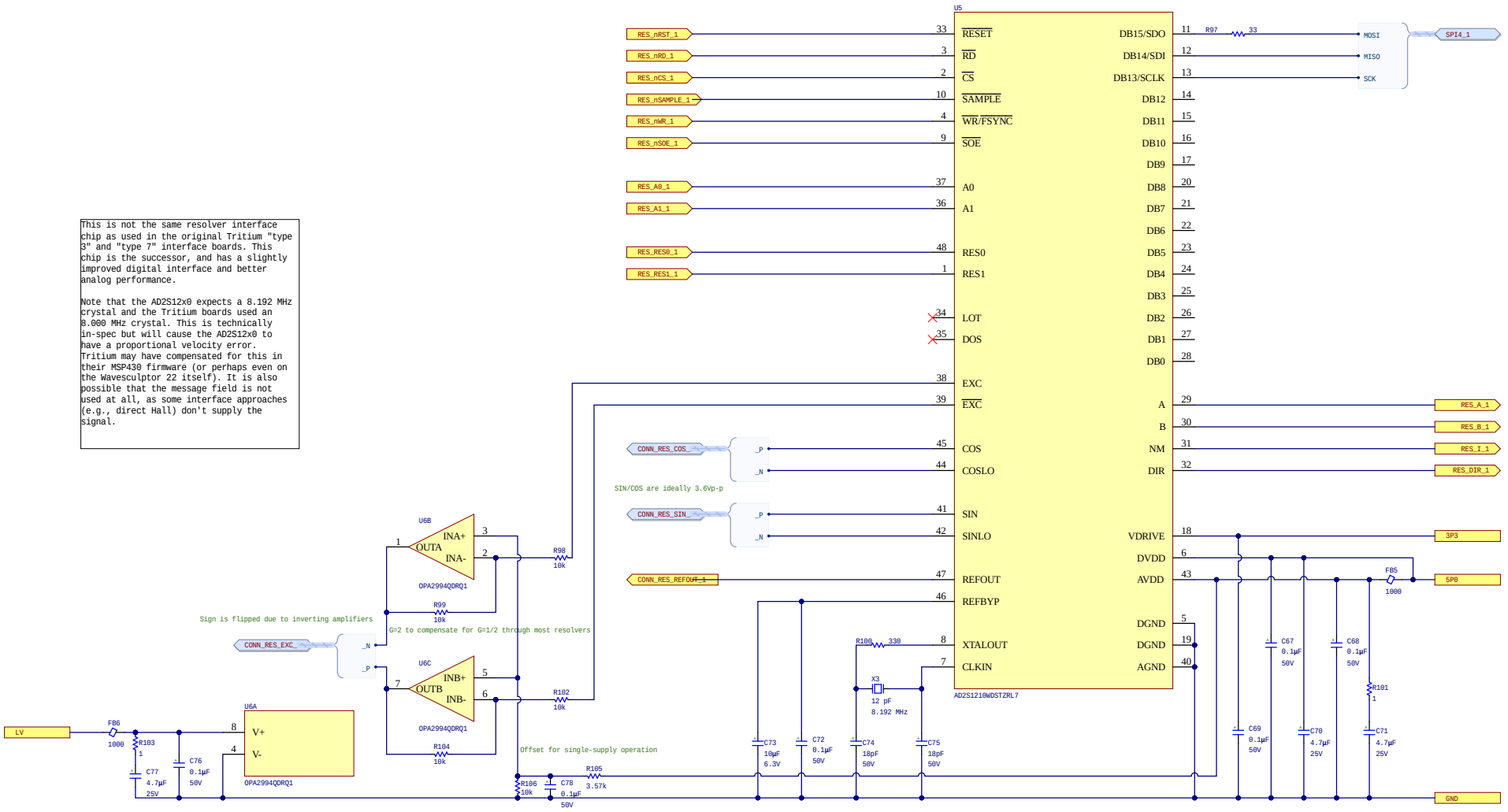
100Base-TX PoE-capable magnetics



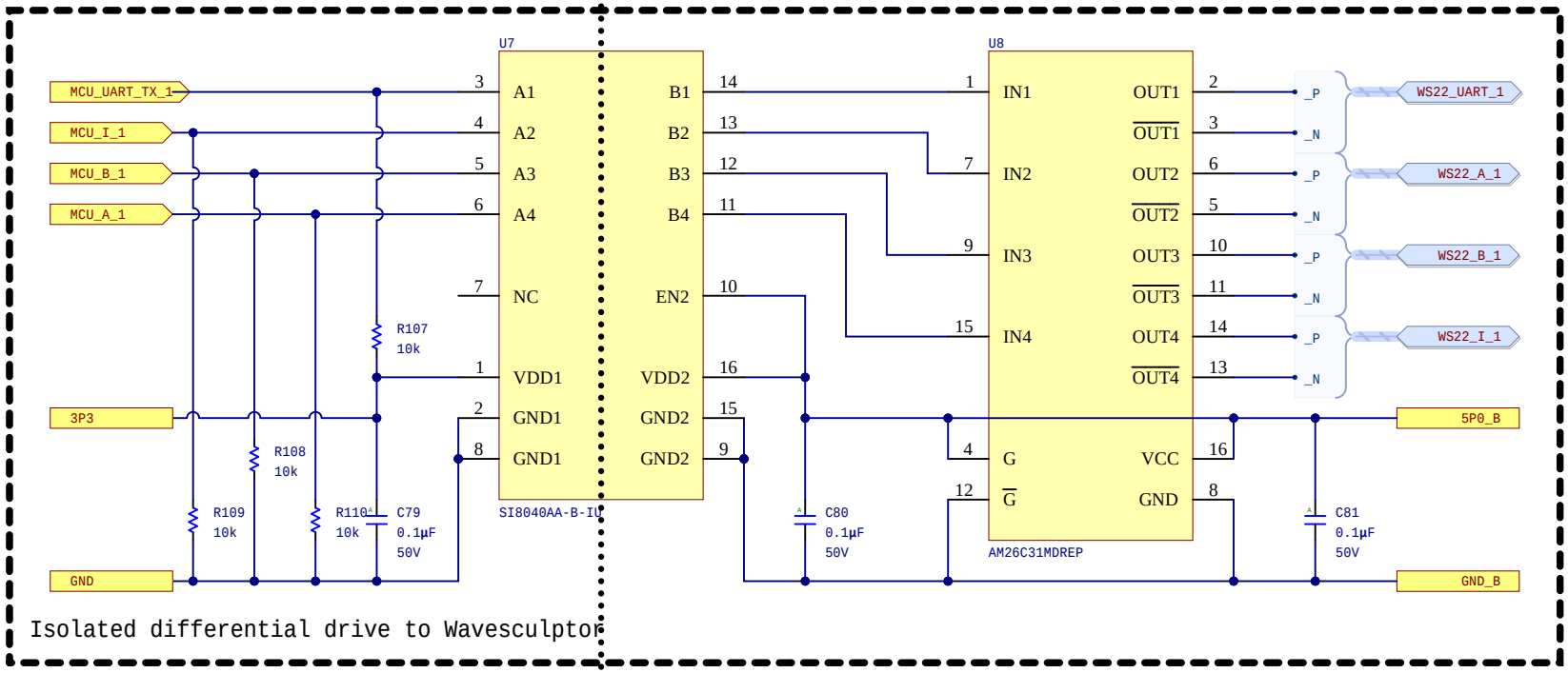
Voltage-translating CAN transceiver


LV
FB4
1000
3P3
R85
10k
R86
10k
D10
MCU_FAN0_PWM_1
R87
1k
FAN0_PWM_1
R88
1k
FAN0_TACH_1
FAN0_POWER_1
D11
MCU_FAN0_TACH_1
R89
1
C62
1µF
25V
C61
0.1µF
50V
GND
4-wire fan interface

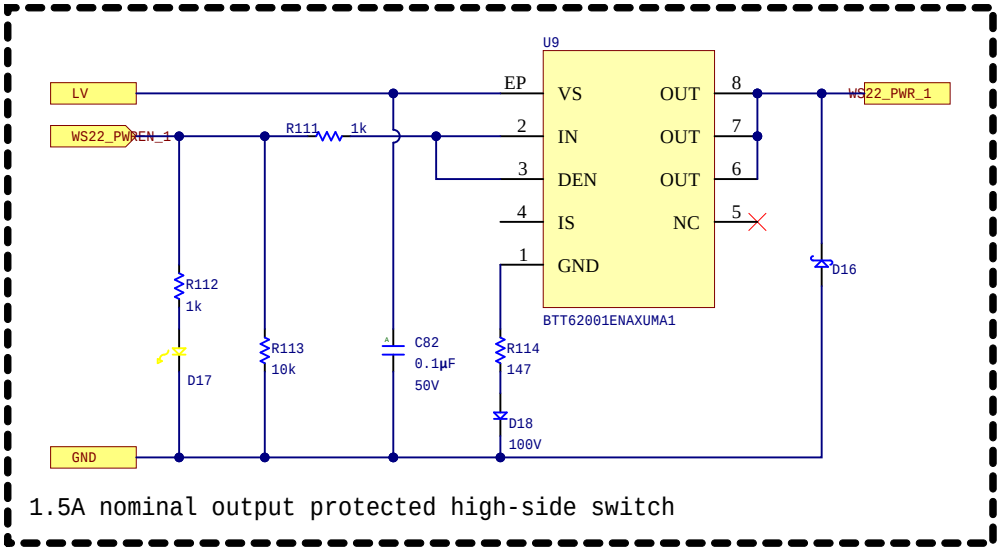

J8
5P0
B4
VBUS
A4
VBUS
C63
10µF
50V
A1
GND
B1
GND
0
SHIELD
TYPE-C-31-M-12
USB-C connector
GND
SBU1
A8
DN1
A7
DP1
A6
CC1
A5
R90
5.1k
Request 5 volts
CC2
B5
R91
5.1k
DP2
B6
R92
33
DN2
B7
R93
33
SBU2
B8
D12
_P
_N
USB


This is not the same resolver interface chip as used in the original Tritium "type 3" and "type 7" interface boards. This chip is the successor, and has a slightly improved digital interface and better analog performance.
Note that the AD2S12x0 expects a 8.192 MHz crystal and the Tritium boards used an 8.000 MHz crystal. This is technically in-spec but will cause the AD2S12x0 to have a proportional velocity error. Tritium may have compensated for this in their MSP430 firmware (or perhaps even on the Wavesculptor 22 itself). It is also possible that the message field is not used at all, as some interface approaches (e.g., direct Hall) don't supply the signal.
U5
AD2S1210WDSTZRL7
RES_nRST_1
RES_nRD_1
RES_nCS_1
RES_nSAMPLE_1
RES_nWR_1
RES_nSOE_1
RES_A0_1
RES_A1_1
RES_RES0_1
RES_RES1_1
RESET
RD
CS
SAMPLE
WR/FSYNC
SOE
A0
A1
RES0
RES1
LOT
DOS
EXC
EXC
COS
COSLO
SIN
SINLO
REFOUT
REFBYP
XTALOUT
CLKIN
DB15/SDO
DB14/SDI
DB13/SCLK
DB12
DB11
DB10
DB9
DB8
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
A
B
NM
DIR
VDRIVE
DVDD
AVDD
DGND
DGND
AGND
R97
33
MOSI
MISO
SCK
SPI4_1
RES_A_1
RES_B_1
RES_I_1
RES_DIR_1
3P3
5P0
GND
CONN_RES_COS_
CONN_RES_SIN_
CONN_RES_REFOUT_1
CONN_RES_EXC_
_P
_N
SIN/COS are ideally 3.6Vp-p
Sign is flipped due to inverting amplifiers
G=2 to compensate for G=1/2 through most resolvers
Offset for single-supply operation
U6A
U6B
U6C
OPA2994QDRQ1
INA+
INA-
OUTA
INB+
INB-
OUTB
V+
V-
R98
10k
R99
10k
R102
10k
R104
10k
R106
10k
R105
3.57k
R100
330
X3
12 pF
8.192 MHz
LV
FB6
1000
FB5
1000
R103
1
R101
1
C77
4.7µF
25V
C76
0.1µF
50V
C78
0.1µF
50V
C73
10µF
6.3V
C72
0.1µF
50V
C74
18pF
50V
C75
18pF
50V
C67
0.1µF
50V
C68
0.1µF
50V
C69
0.1µF
50V
C70
4.7µF
25V
C71
4.7µF
25V

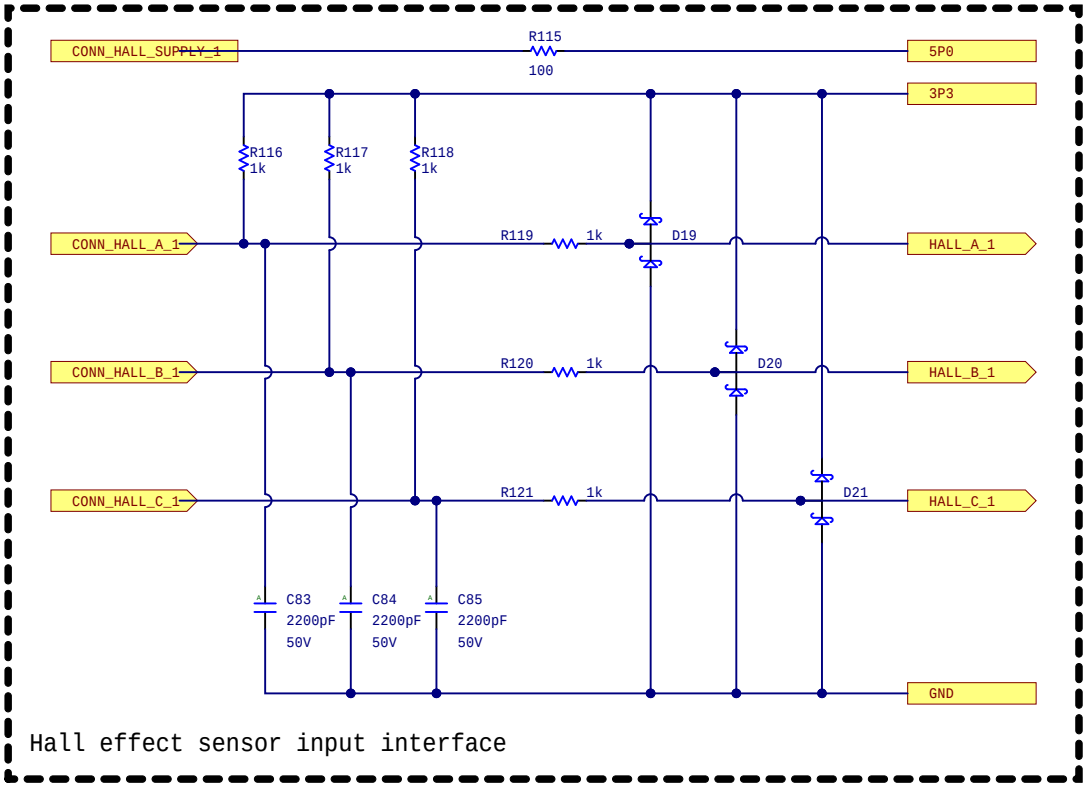
LV domain HV domain



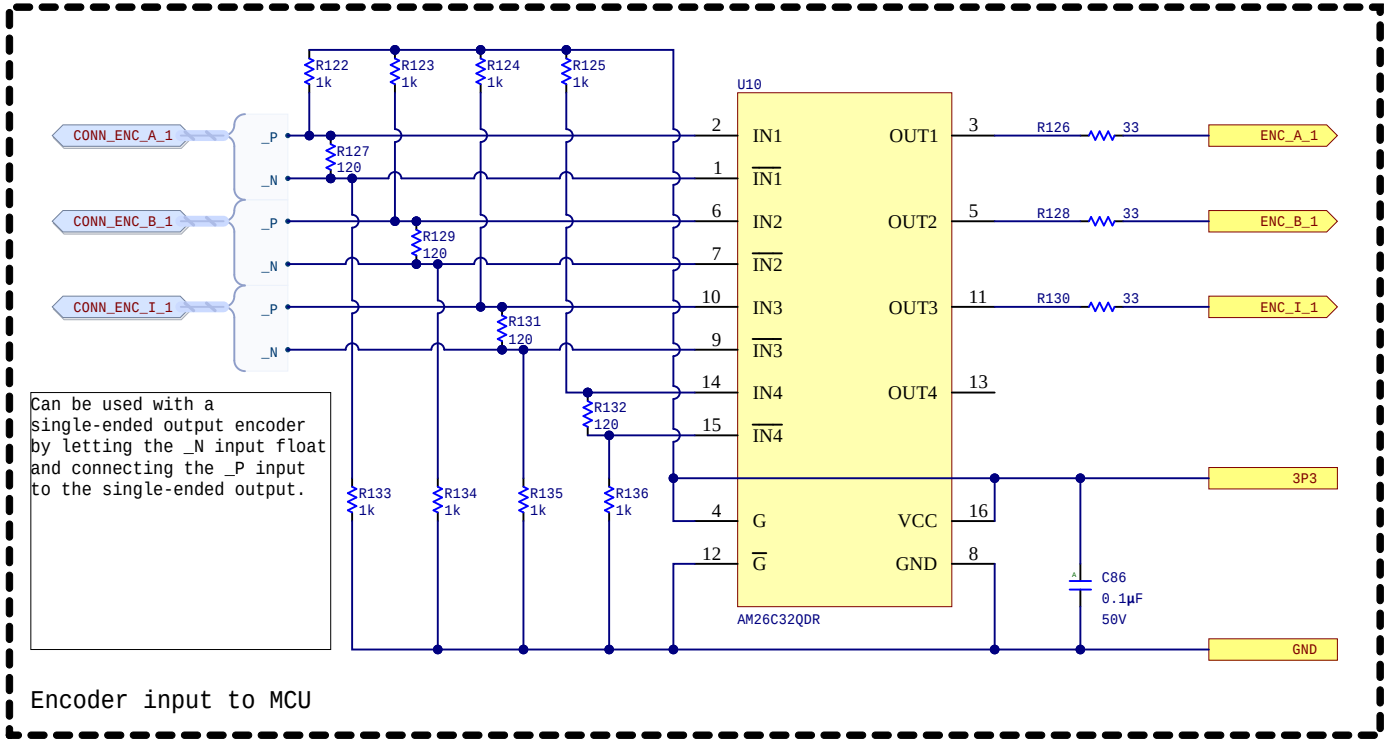
Isolated differential drive to Wavesculptor

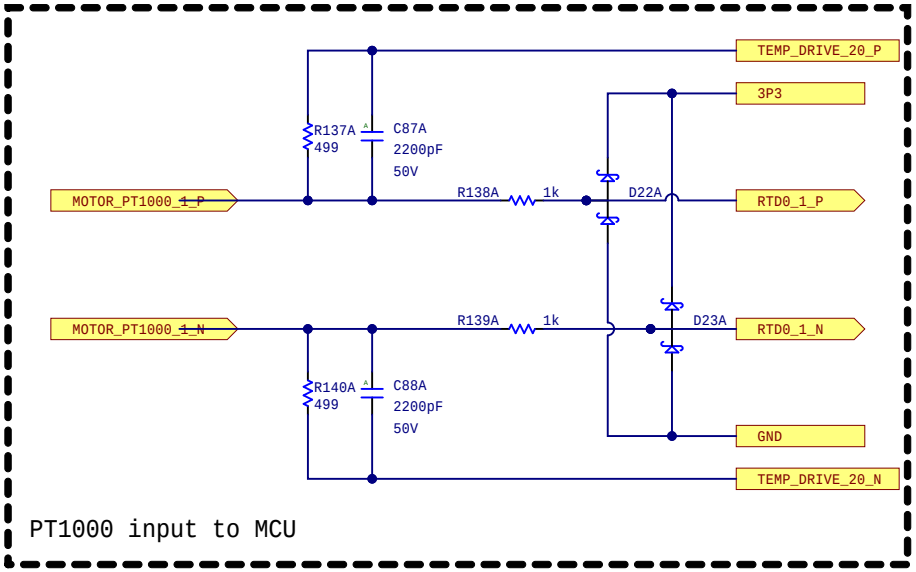


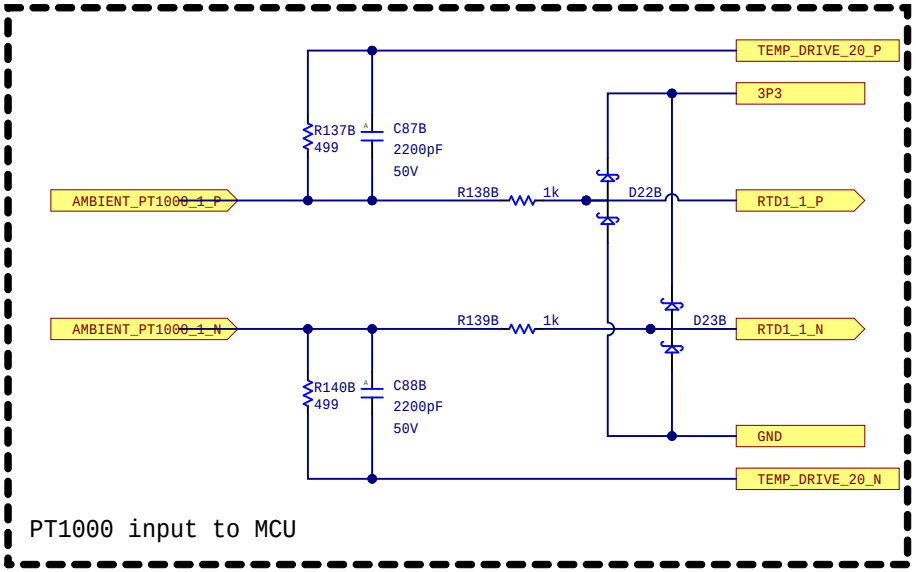
1.5A nominal output protected high-side switch

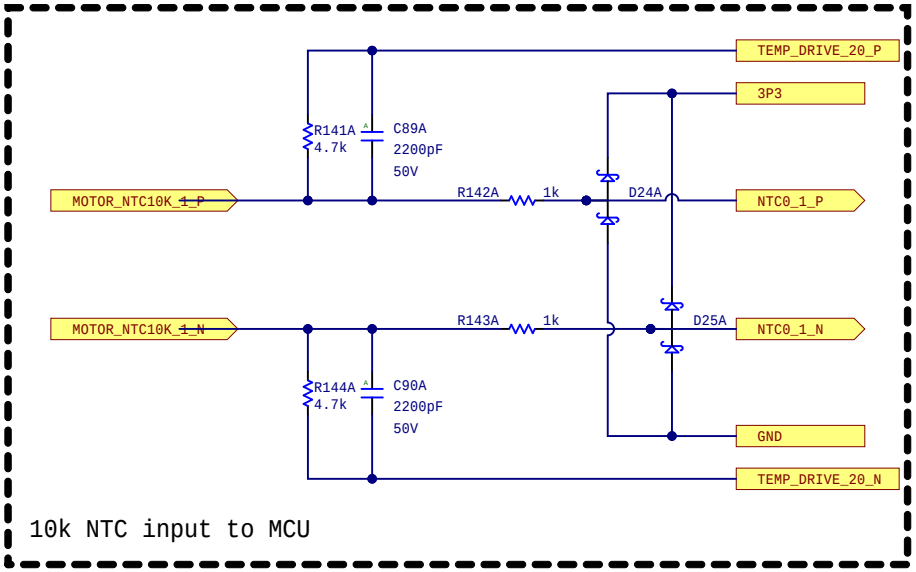


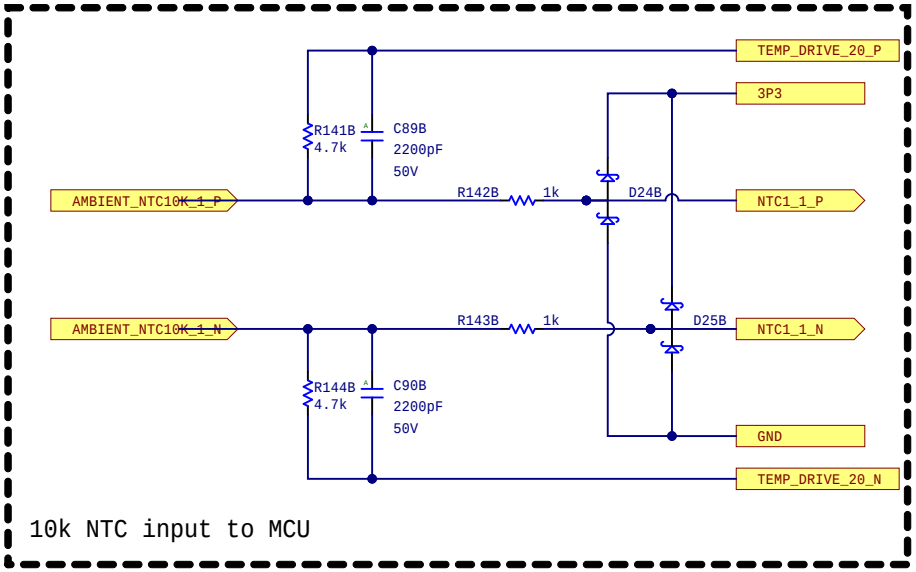
Hall effect sensor input interface

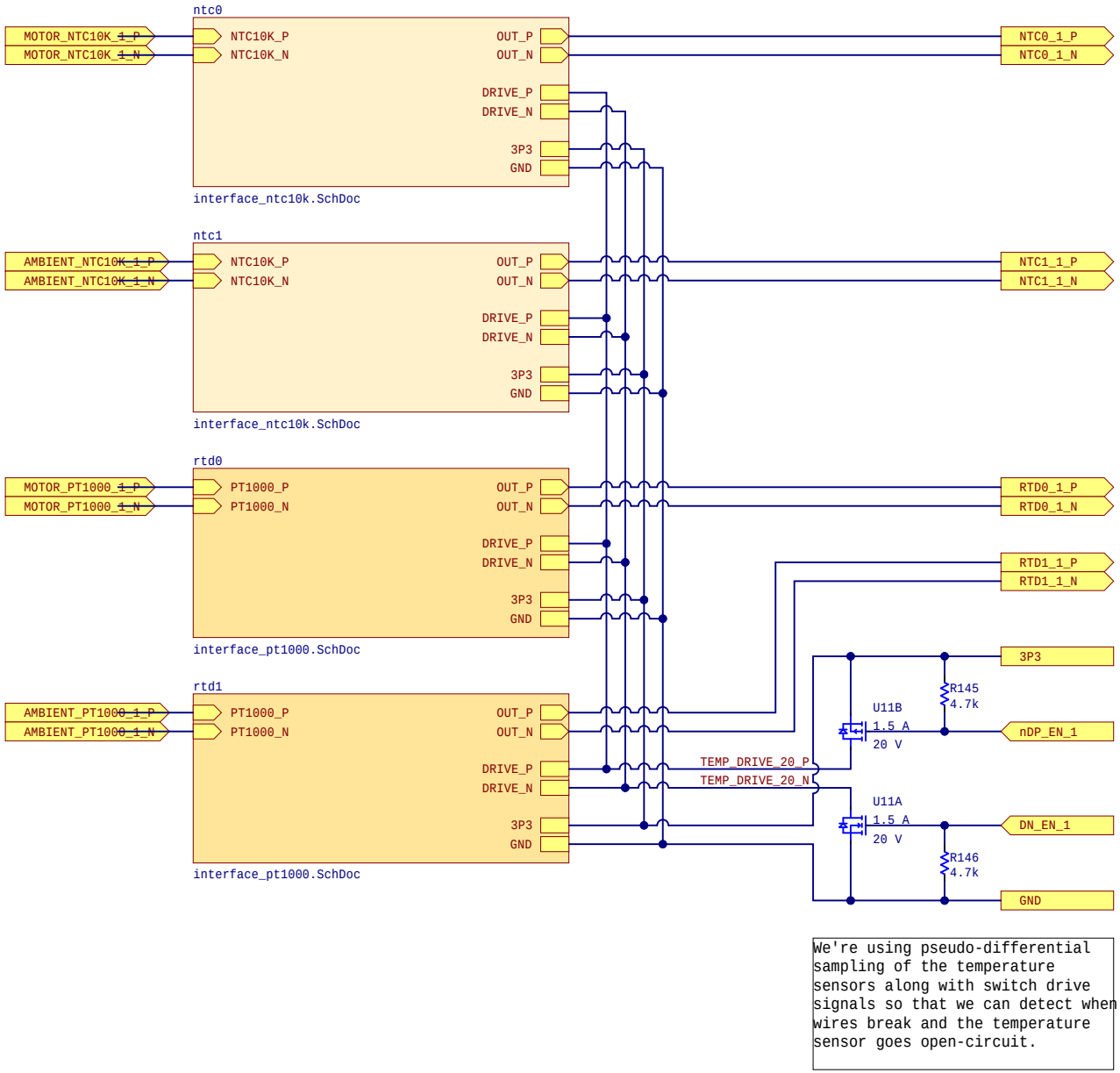

R122
1k
R123
1k
R124
1k
R125
1k
U10
CONN_ENC_A_1
CONN_ENC_B_1
CONN_ENC_I_1
_P
_N
_P
_N
_P
_N
R127
120
R129
120
R131
120
R132
120
2
IN1
1
IN1
6
IN2
7
IN2
10
IN3
9
IN3
14
IN4
15
IN4
4
G
12
G
3
OUT1
5
OUT2
11
OUT3
13
OUT4
16
VCC
8
GND
R126
33
R128
33
R130
33
ENC_A_1
ENC_B_1
ENC_I_1
3P3
GND
R133
1k
R134
1k
R135
1k
R136
1k
C86
0.1µF
50V
AM26C32QDR
Can be used with a
single-ended output encoder
by letting the _N input float
and connecting the _P input
to the single-ended output.
Encoder input to MCU


TEMP_DRIVE_20_P
3P3
R137A
499
C87A
2200pF
50V
MOTOR_PT1000_1_P
R138A
1k
D22A
RTD0_1_P
MOTOR_PT1000_1_N
R139A
1k
D23A
RTD0_1_N
R140A
499
C88A
2200pF
50V
GND
TEMP_DRIVE_20_N
PT1000 input to MCU


TEMP_DRIVE_20_P
3P3
R137B
499
C87B
2200pF
50V
AMBIENT_PT1000_1_P
R138B
1k
D22B
RTD1_1_P
AMBIENT_PT1000_1_N
R139B
1k
D23B
RTD1_1_N
R140B
499
C88B
2200pF
50V
GND
TEMP_DRIVE_20_N
PT1000 input to MCU


TEMP_DRIVE_20_P
3P3
R141A
4.7k
C89A
2200pF
50V
MOTOR_NTC10K_1_P
R142A
1k
D24A
NTC0_1_P
MOTOR_NTC10K_1_N
R143A
1k
D25A
NTC0_1_N
R144A
4.7k
C90A
2200pF
50V
GND
TEMP_DRIVE_20_N
10k NTC input to MCU


TEMP_DRIVE_20_P
3P3
R141B
4.7k
C89B
2200pF
50V
AMBIENT_NTC10K_1_P
R142B
1k
D24B
NTC1_1_P
AMBIENT_NTC10K_1_N
R143B
1k
D25B
NTC1_1_N
R144B
4.7k
C90B
2200pF
50V
GND
TEMP_DRIVE_20_N
10k NTC input to MCU


ntc0
MOTOR_NTC10K_1_P
MOTOR_NTC10K_1_N
NTC10K_P
NTC10K_N
OUT_P
OUT_N
DRIVE_P
DRIVE_N
3P3
GND
interface_ntc10k.SchDoc
NTC0_1_P
NTC0_1_N
ntc1
AMBIENT_NTC10K_1_P
AMBIENT_NTC10K_1_N
NTC10K_P
NTC10K_N
OUT_P
OUT_N
DRIVE_P
DRIVE_N
3P3
GND
interface_ntc10k.SchDoc
NTC1_1_P
NTC1_1_N
rtd0
MOTOR_PT1000_1_P
MOTOR_PT1000_1_N
PT1000_P
PT1000_N
OUT_P
OUT_N
DRIVE_P
DRIVE_N
3P3
GND
interface_pt1000.SchDoc
RTD0_1_P
RTD0_1_N
RTD1_1_P
RTD1_1_N
rtd1
AMBIENT_PT1000_1_P
AMBIENT_PT1000_1_N
PT1000_P
PT1000_N
OUT_P
OUT_N
DRIVE_P
DRIVE_N
3P3
GND
interface_pt1000.SchDoc
TEMP_DRIVE_20_P
TEMP_DRIVE_20_N
U11B
1.5 A
20 V
U11A
1.5 A
20 V
3P3
R145
4.7k
nDP_EN_1
DN_EN_1
R146
4.7k
GND
We're using pseudo-differential sampling of the temperature sensors along with switch drive signals so that we can detect when wires break and the temperature sensor goes open-circuit.