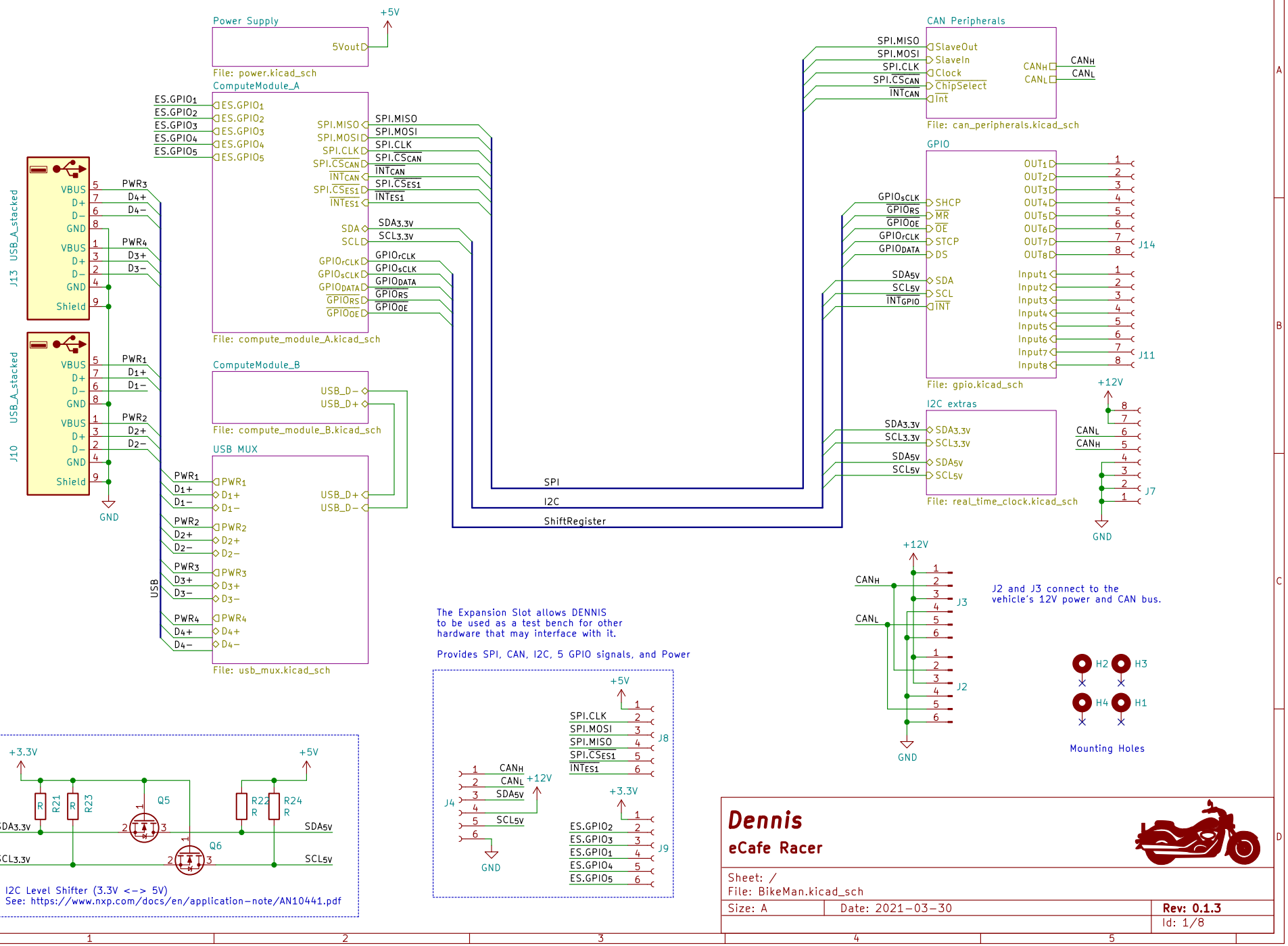
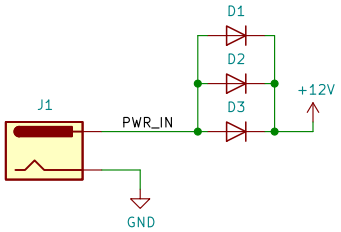
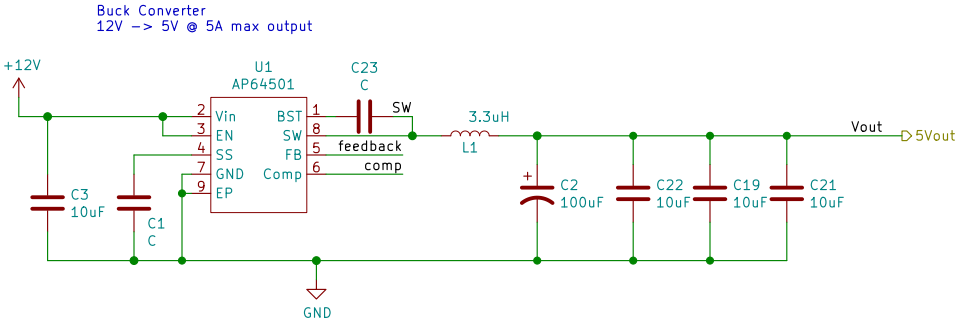
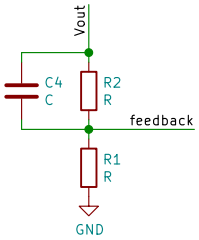

Power Supply
+5V
5Vout
File: power.kicad_sch
ComputeModule_A
ES.GPIO1
ES.GPIO2
ES.GPIO3
ES.GPIO4
ES.GPIO5
SPI.MISO
SPI.MOSI
SPI.CLK
SPI.CSCAN
INTCAN
SPI.CSES1
INTES1
SDA
SCL
SDA3.3V
SCL3.3V
GPIOrCLK
GPIOsCLK
GPIODATA
GPIORS
GPIOOE
File: compute_module_A.kicad_sch
ComputeModule_B
USB_D−
USB_D+
File: compute_module_B.kicad_sch
USB MUX
PWR1
PWR2
PWR3
PWR4
D1+
D1−
D2+
D2−
D3+
D3−
D4+
D4−
USB
File: usb_mux.kicad_sch
J13 USB_A_stacked
J10 USB_A_stacked
VBUS
D+
D−
GND
Shield
GND
CAN Peripherals
SPI.MISO
SPI.MOSI
SPI.CLK
SPI.CSCAN
INTCAN
SlaveOut
SlaveIn
Clock
ChipSelect
Int
CANH
CANL
File: can_peripherals.kicad_sch
GPIO
GPIOsCLK
GPIORS
GPIOOE
GPIOrCLK
GPIODATA
SHCP
MR
OE
STCP
DS
SDA5V
SCL5V
INTGPIO
SDA
SCL
INT
OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
OUT7
OUT8
J14
Input1
Input2
Input3
Input4
Input5
Input6
Input7
Input8
J11
File: gpio.kicad_sch
I2C extras
SDA3.3V
SCL3.3V
SDA5V
SCL5V
File: real_time_clock.kicad_sch
+12V
CANL
CANH
J7
GND
SPI
I2C
ShiftRegister
+12V
CANH
CANL
J3
J2
GND
J2 and J3 connect to the
vehicle's 12V power and CAN bus.
H2
H3
H4
H1
Mounting Holes
The Expansion Slot allows DENNIS
to be used as a test bench for other
hardware that may interface with it.
Provides SPI, CAN, I2C, 5 GPIO signals, and Power
+5V
SPI.CLK
SPI.MOSI
SPI.MISO
SPI.CSES1
INTES1
J8
+3.3V
ES.GPIO2
ES.GPIO3
ES.GPIO1
ES.GPIO4
ES.GPIO5
J9
J4
CANH
CANL
+12V
SDA5V
SCL5V
GND
+3.3V
+5V
R21
R23
R22
R24
Q5
Q6
SDA3.3V
SCL3.3V
SDA5V
SCL5V
I2C Level Shifter (3.3V <−> 5V)
See: https://www.nxp.com/docs/en/application−note/AN10441.pdf
Dennis
eCafe Racer
Sheet: /
File: BikeMan.kicad_sch
Size: A
Date: 2021−03−30
Rev: 0.1.3
Id: 1/8



Diodes prevent alternative 12V power sources from flowing back into this supply

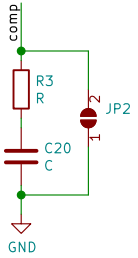




Feedback Circuit

Vout is determined by this feedback divider circuit with the equation:
$R_{high} = R_{low} * (V_{out} / 0.8V - 1)$

*C4 is optional for improving transient response
*Use at least 1% precision resistors



Compensation Circuit

*See Datasheet

Dennis uses 3 distinct supply voltages: 3.3V, 5V, and 12V

The board is powered by a 12V supply from either a DC barrel jack (J3), or the Bike's internal power bus (J1, J2)

A Buck converter steps the 12V supply down to 5V, which is used to power most of the board's components, including the Raspberry Pi

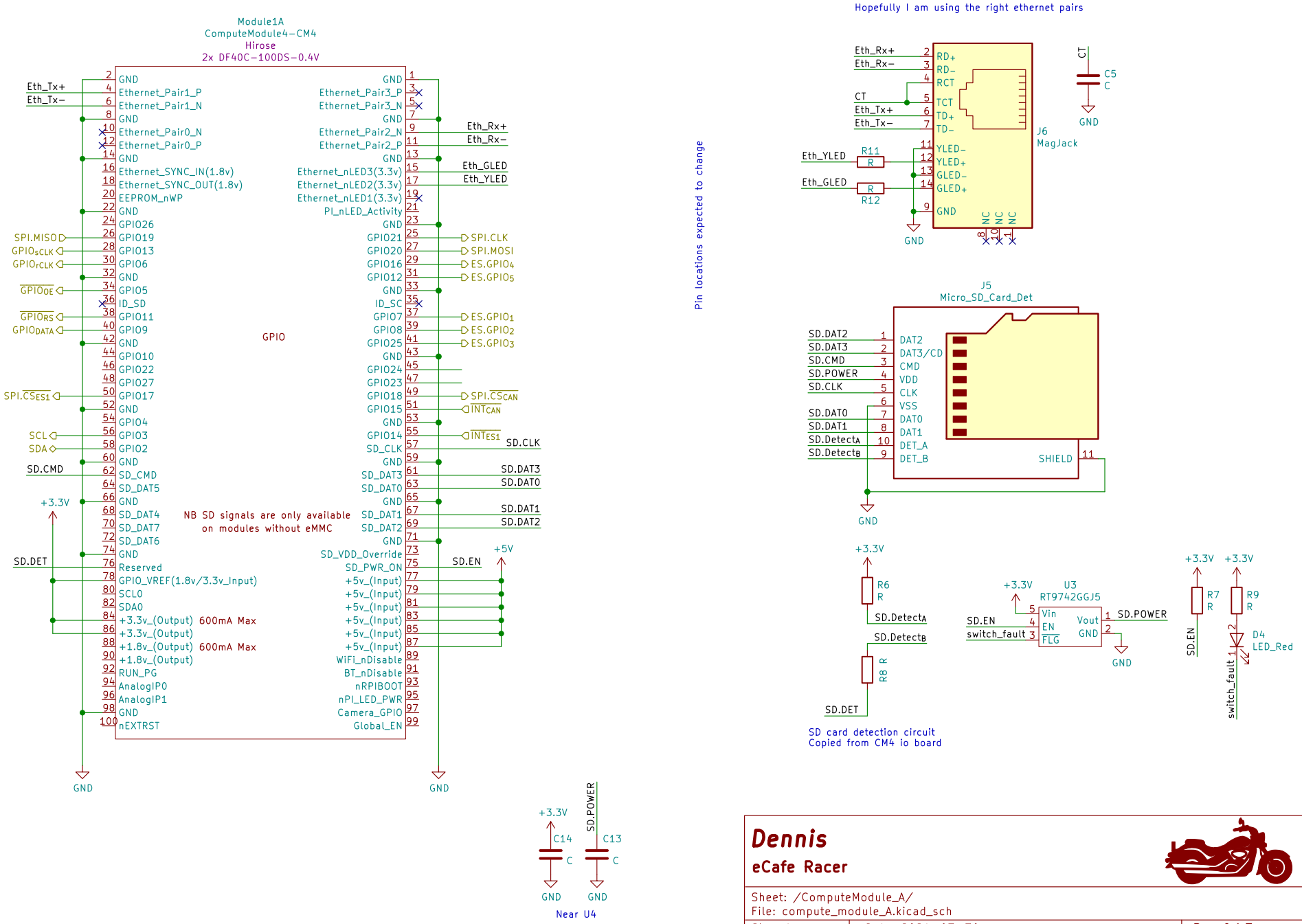
The Raspberry Pi has an internal voltage regulator which further steps down the 5V supply to 3.3V, which is used to power its internal components as well as certain components on this board.

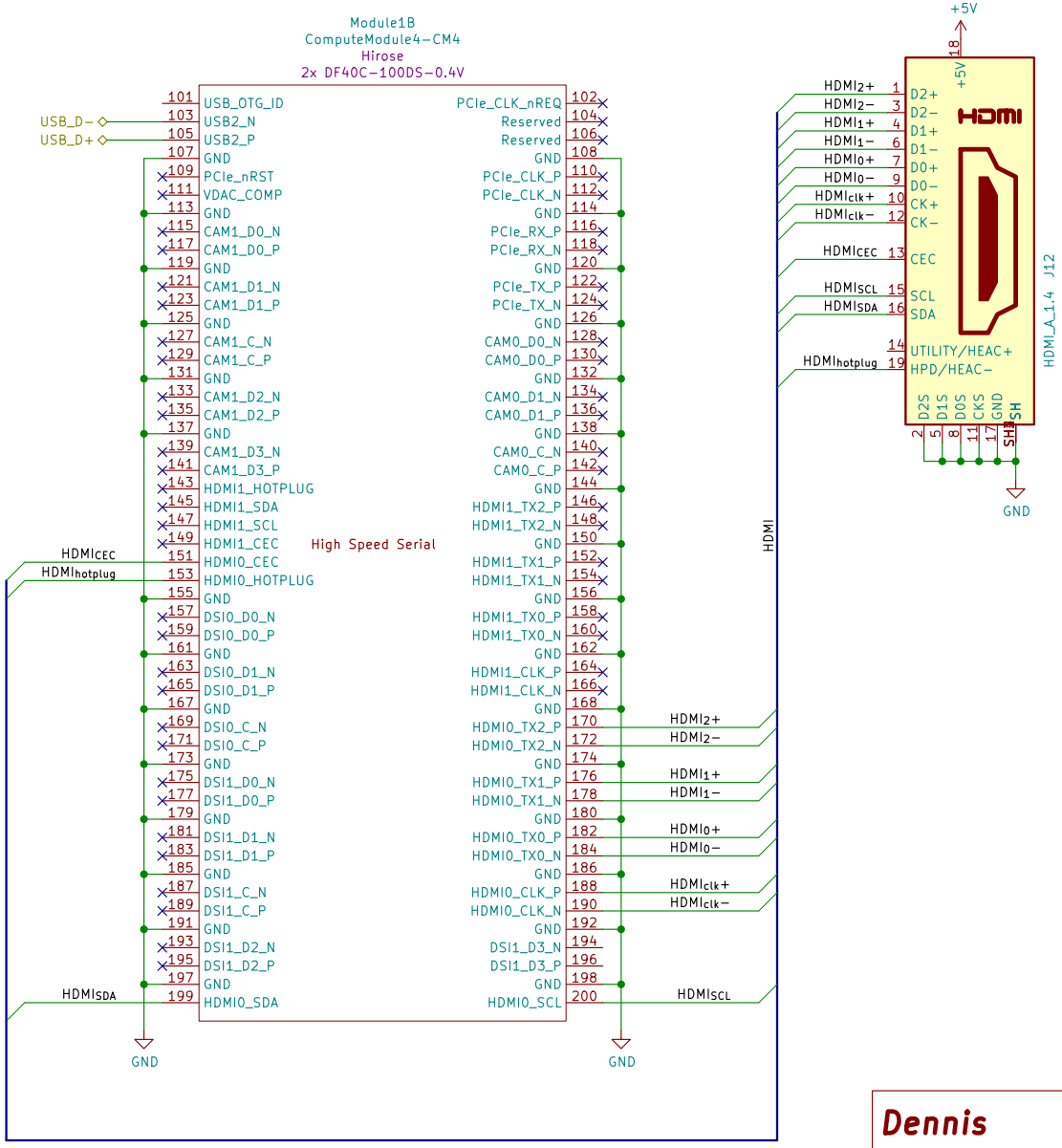
Dennis

eCafe Racer

Sheet: /Power Supply/
File: power.kicad_sch

Size: A	Date: 2021-03-30	**Rev: 0.1.3**
		Id: 2/8


Module1A
ComputeModule4-CM4
Hirose
2x DF40C-100DS-0.4V
GPIO
NB SD signals are only available on modules without eMMC
Pin locations expected to change
Hopefully I am using the right ethernet pairs
J6
MagJack
J5
Micro_SD_Card_Det
SD card detection circuit
Copied from CM4 io board
U3
RT9742GGJ5
Near U4
Dennis
eCafe Racer
Sheet: /ComputeModule_A/
File: compute_module_A.kicad_sch
Size: A
Date: 2021-03-30
Rev: 0.1.3
Id: 3/8



Dennis

eCafe Racer

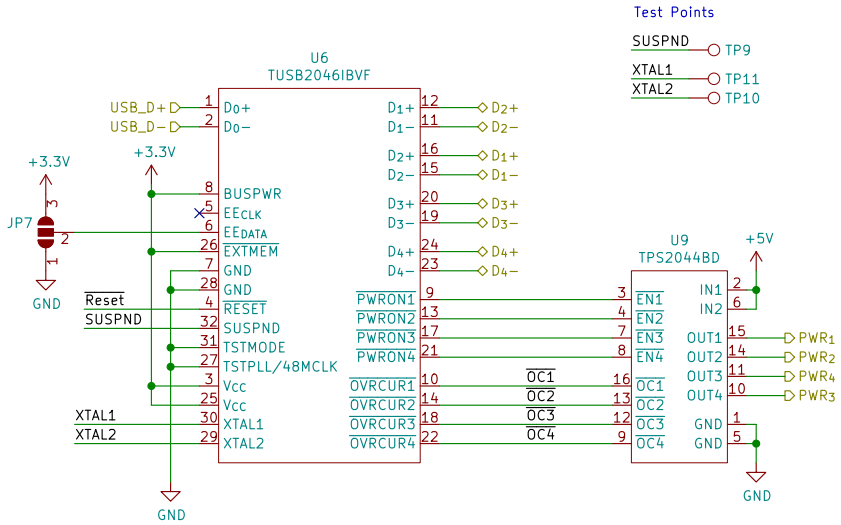
Sheet: /ComputeModule_B/		
File: compute_module_B.kicad_sch		
Size: A	Date: 2021-03-30	**Rev: 0.1.3**
		Id: 4/8

USB hub IC allows up to 4 devices to talk to the Raspberry Pi's USB port. This is mainly to allow hooking up a keyboard and mouse to the board for debugging and configuration, but could also be used to test USB sensors like a Camera or GPS receiver.

JP7 decides Ganged vs Per Port overcurrent protection

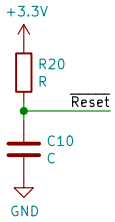
HIGH = Ganged Mode
LOW = Per Port Mode

see datasheet section 8.3.1

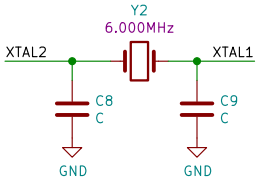


Test Points

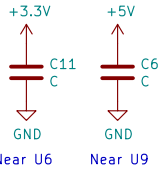
Power−On−Reset Circuit



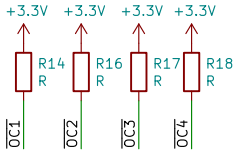
Crystal Oscillator



Bypass Capacitors



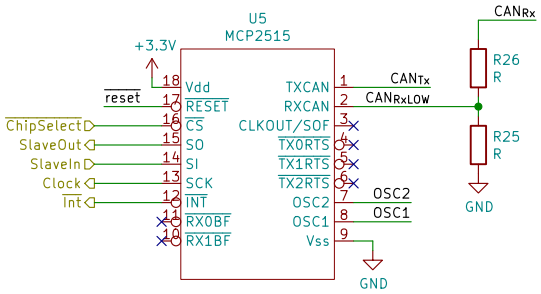
Pull Up Resistors



Dennis
eCafe Racer

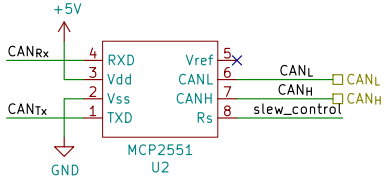
Sheet: /USB MUX/
File: usb_mux.kicad_sch

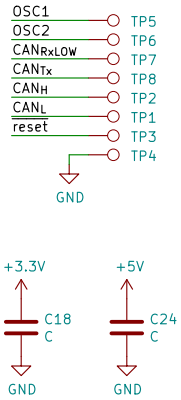
Size: A	Date: 2021−03−30	**Rev: 0.1.3**
		Id: 5/8

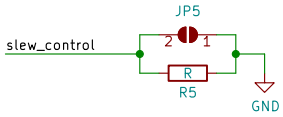


Voltage divider converts 5V logic to 3.3V logic.
Values taken from here:
http://skpang.co.uk/catalog/images/raspberrypi/pi_2/pican2_rev_B.pdf

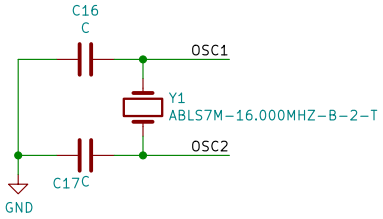
V_{out} / V_{in} = 0.3



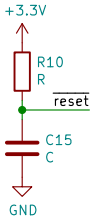




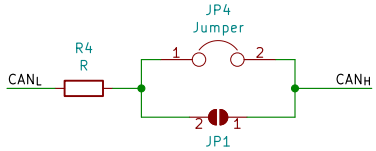
Slew Rate Control circuit.
The slew rate of CAN_H and CAN_L are determined by
the resistance between the Rs pin and ground. Connect directly
to ground for high speed mode, or limit the slew rate to help with EMI
reduction



Crystal Oscillator Circuit
(16MHz)



Power On Reset Circuit
Needs to hold reset state for >2us
after power up

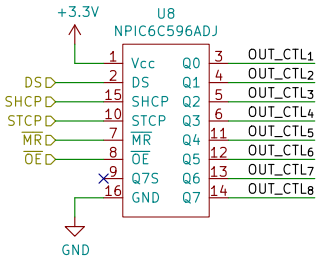


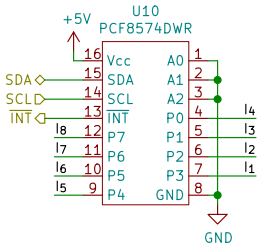
120 ohm termination resistor required by CAN bus.
Can be configured with either jumper or solder bridge

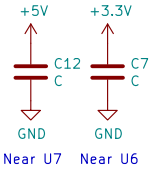
Dennis
eCafe Racer

Sheet: /CAN Peripherals/
File: can_peripherals.kicad_sch

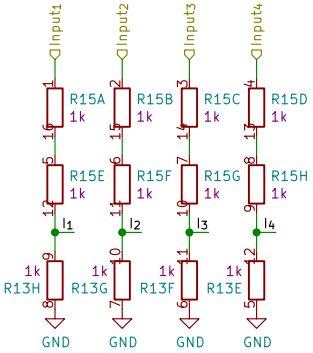
Size: A	Date: 2021-03-30	**Rev: 0.1.3**
		Id: 6/8



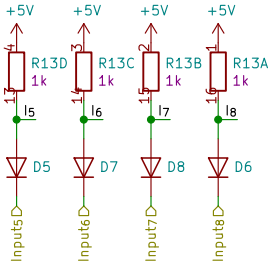




An I2C IO expander is used to read the inputs instead of connecting to the pi's gpio pins directly. This is mainly done for insurance so that the pi's pins cannot be accidentally exposed to the 12V signal.

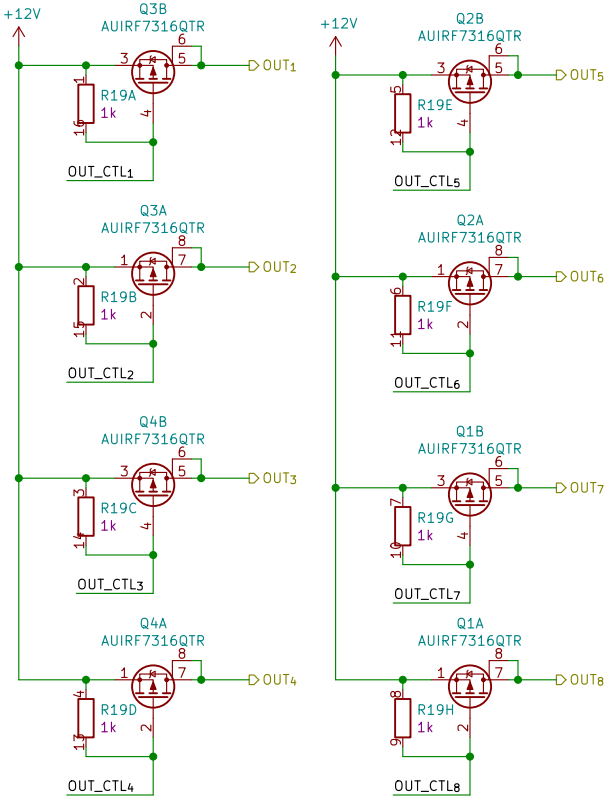


Voltage Divider Network
(1 / 3 : 12V -> 4V)
Used to read 12V digital signals from other parts of the bike



Switch To Ground Detector
Used to read state of simple mechanical switches on the bike.

Diodes prevent failure from miswiring of the two input types



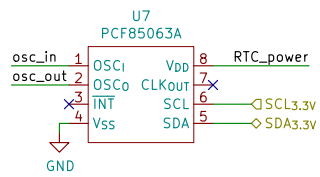
By far the most common use for these inputs will be to read the value of switches. Need to think more about the best way to achieve this, it is most likely not this.

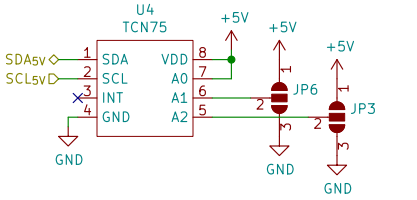
It might be nice to combine Input and Output pins into a single circuit which can be configured in software to act like either, like the gpio modules on microprocessors. Perhaps a "switch detection" mode could be added as well, which measures the resistance to ground instead of voltage

Dennis

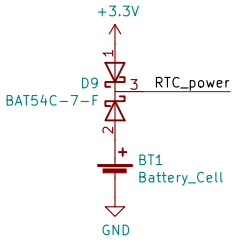
eCafe Racer

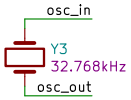
Sheet: /GPIO/		
File: gpio.kicad_sch		
Size: A	Date: 2021-03-30	**Rev: 0.1.3**
		Id: 7/8





Address Select Jumpers





Dennis

eCafe Racer

Sheet: /I2C extras/
File: real_time_clock.kicad_sch

Size: A	Date: 2021-03-30	**Rev: 0.1.3**
		Id: 8/8