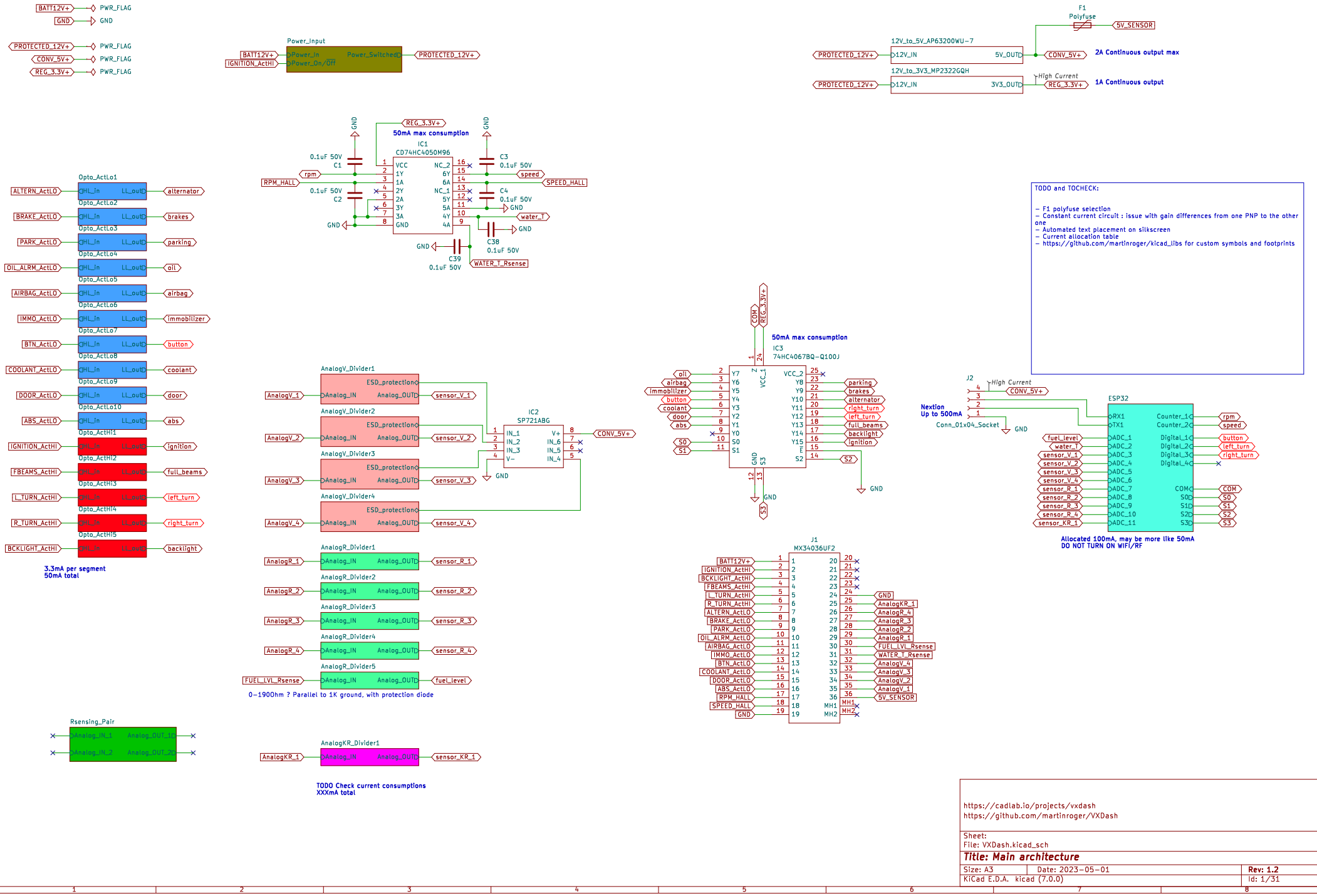
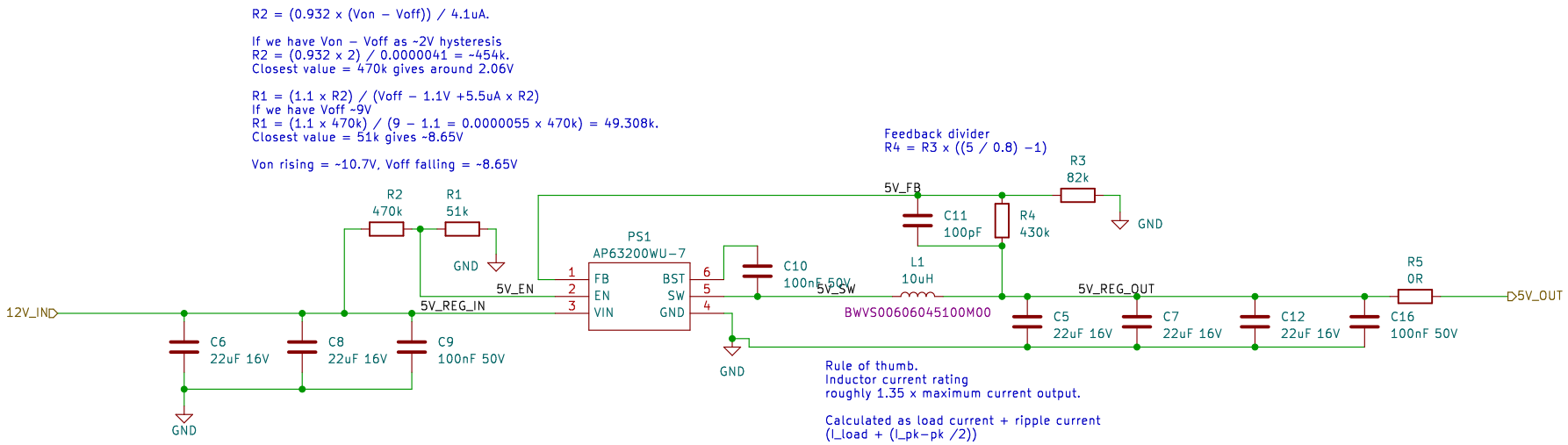

BATT12V+
PWR_FLAG
GND
GND
PROTECTED_12V+
PWR_FLAG
CONV_5V+
PWR_FLAG
REG_3.3V+
PWR_FLAG
Power_Input
BATT12V+
IGNITION_ActHI
Power_In
Power_On/Off
Power_Switched
PROTECTED_12V+
F1
Polyfuse
5V_SENSOR
12V_to_5V_AP63200WU-7
PROTECTED_12V+
12V_IN
5V_OUT
CONV_5V+
2A Continuous output max
12V_to_3V3_MP2322GQH
PROTECTED_12V+
12V_IN
3V3_OUT
High Current
REG_3.3V+
1A Continuous output
GND
REG_3.3V+
50mA max consumption
IC1
CD74HC4050M96
0.1uF 50V
C1
rpm
RPM_HALL
0.1uF 50V
C2
GND
C3
0.1uF 50V
speed
SPEED_HALL
C4
0.1uF 50V
GND
water_T
GND
C38
0.1uF 50V
GND
C39
0.1uF 50V
WATER_T_Rsense
Opto_ActLo1
ALTERN_ActLO
alternator
Opto_ActLo2
BRAKE_ActLO
brakes
Opto_ActLo3
PARK_ActLO
parking
Opto_ActLo4
OIL_ALRM_ActLO
oil
Opto_ActLo5
AIRBAG_ActLO
airbag
Opto_ActLo6
IMMO_ActLO
immobilizer
Opto_ActLo7
BTN_ActLO
button
Opto_ActLo8
COOLANT_ActLO
coolant
Opto_ActLo9
DOOR_ActLO
door
Opto_ActLo10
ABS_ActLO
abs
Opto_ActHI1
IGNITION_ActHI
ignition
Opto_ActHI2
FBEAMS_ActHI
full_beams
Opto_ActHI3
L_TURN_ActHI
left_turn
Opto_ActHI4
R_TURN_ActHI
right_turn
Opto_ActHI5
BCKLIGHT_ActHI
backlight
3.3mA per segment
50mA total
AnalogV_Divider1
AnalogV_1
ESD_protection
Analog_IN
Analog_OUT
sensor_V_1
AnalogV_Divider2
AnalogV_2
sensor_V_2
AnalogV_Divider3
AnalogV_3
sensor_V_3
AnalogV_Divider4
AnalogV_4
sensor_V_4
IC2
SP721ABG
IN_1
IN_2
IN_3
V-
V+
IN_6
IN_5
IN_4
CONV_5V+
GND
AnalogR_Divider1
AnalogR_1
sensor_R_1
AnalogR_Divider2
AnalogR_2
sensor_R_2
AnalogR_Divider3
AnalogR_3
sensor_R_3
AnalogR_Divider4
AnalogR_4
sensor_R_4
AnalogR_Divider5
FUEL_LVL_Rsense
fuel_level
0-190Ohm ? Parallel to 1K ground, with protection diode
Rsensing_Pair
Analog_IN_1
Analog_IN_2
Analog_OUT_1
Analog_OUT_2
AnalogKR_Divider1
AnalogKR_1
sensor_KR_1
TODO Check current consumptions
XXXmA total
COM
REG_3.3V+
50mA max consumption
IC3
74HC4067BQ-Q100J
oil
airbag
immobilizer
button
coolant
door
abs
S0
S1
parking
brakes
alternator
right_turn
left_turn
full_beams
backlight
ignition
S2
S3
GND
J1
MX34036UF2
BATT12V+
IGNITION_ActHI
BCKLIGHT_ActHI
FBEAMS_ActHI
L_TURN_ActHI
R_TURN_ActHI
ALTERN_ActLO
BRAKE_ActLO
PARK_ActLO
OIL_ALRM_ActLO
AIRBAG_ActLO
IMMO_ActLO
BTN_ActLO
COOLANT_ActLO
DOOR_ActLO
ABS_ActLO
RPM_HALL
SPEED_HALL
GND
AnalogKR_1
AnalogR_4
AnalogR_3
AnalogR_2
AnalogR_1
FUEL_LVL_Rsense
WATER_T_Rsense
AnalogV_4
AnalogV_3
AnalogV_2
AnalogV_1
5V_SENSOR
MH1
MH2
J2
High Current
CONV_5V+
Nextion
Up to 500mA
Conn_01x04_Socket
GND
ESP32
RX1
TX1
ADC_1
ADC_2
ADC_3
ADC_4
ADC_5
ADC_6
ADC_7
ADC_8
ADC_9
ADC_10
ADC_11
Counter_1
Counter_2
Digital_1
Digital_2
Digital_3
Digital_4
COM
S0
S1
S2
S3
fuel_level
water_T
sensor_V_1
sensor_V_2
sensor_V_3
sensor_V_4
sensor_R_1
sensor_R_2
sensor_R_3
sensor_R_4
sensor_KR_1
rpm
speed
button
left_turn
right_turn
Allocated 100mA, may be more like 50mA
DO NOT TURN ON WIFI/RF
TODO and TOCHECK:
- F1 polyfuse selection
- Constant current circuit : issue with gain differences from one PNP to the other one
- Automated text placement on silkscreen
- Current allocation table
- https://github.com/martinroger/kicad_libs for custom symbols and footprints
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash
Sheet:
File: VXDash.kicad_sch
Title: Main architecture
Size: A3
Date: 2023-05-01
Rev: 1.2
KiCad E.D.A. kicad (7.0.0)
Id: 1/31



MAX 2A CONTINUOUS OUTPUT

All resistors low tolerance
All capacitors low ESR

https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: 12V_to_5V_AP63200WU−7.kicad_sch

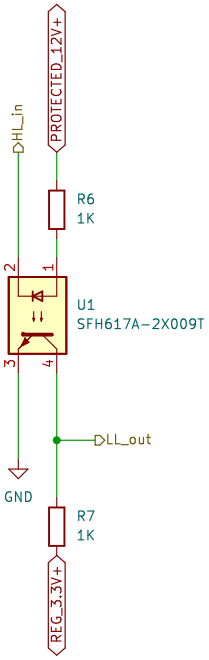
Title: 12V to 5V conversion

Size: A4	Date: 2023−05−01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 2/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActLo.kicad_sch

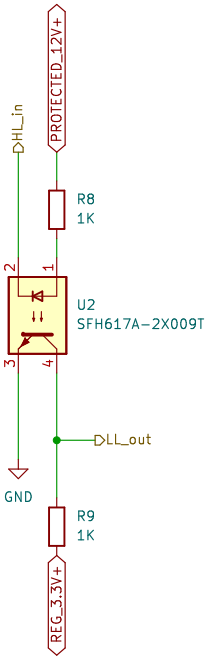
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 3/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActLo.kicad_sch

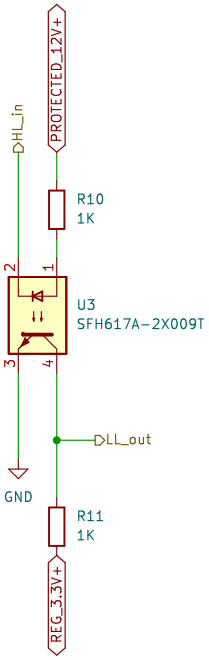
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 4/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActLo.kicad_sch

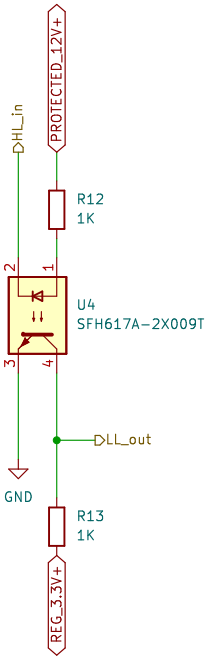
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 5/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActLo.kicad_sch

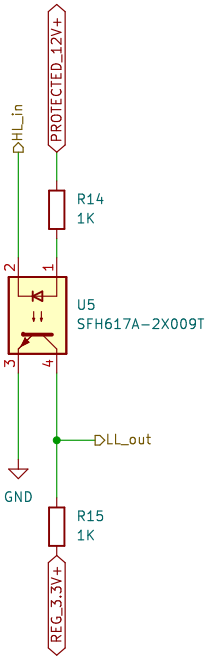
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 6/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActLo.kicad_sch

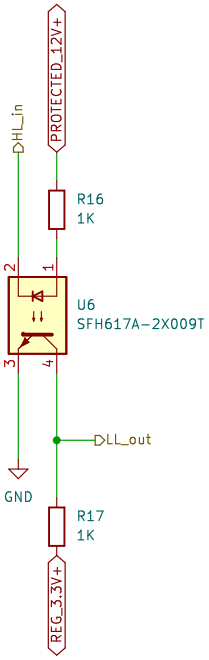
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 7/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActLo.kicad_sch

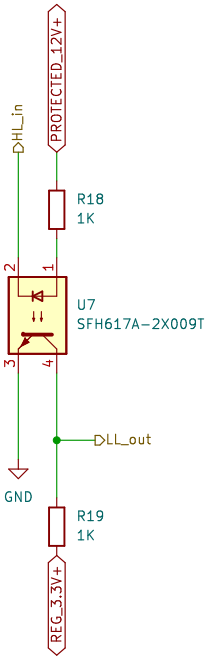
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 8/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActLo.kicad_sch

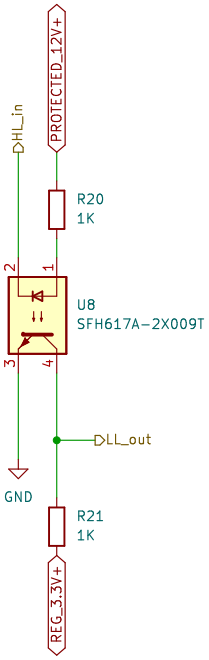
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 9/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActLo.kicad_sch

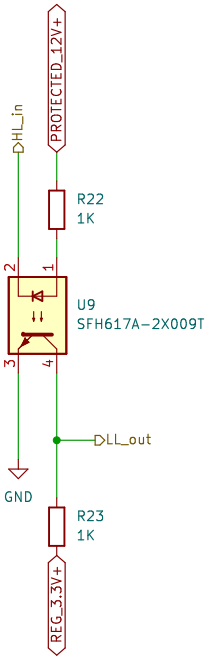
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 10/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActLo.kicad_sch

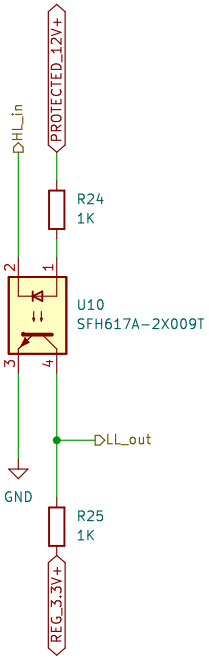
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 11/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActLo.kicad_sch

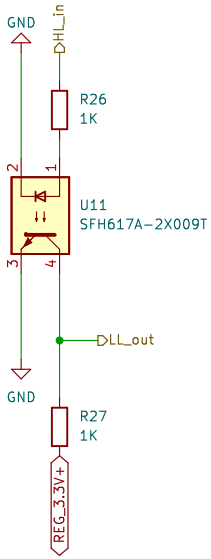
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 12/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActHi.kicad_sch

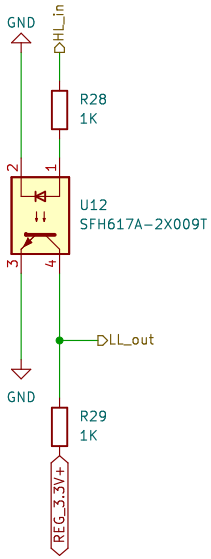
Title: Active Hi Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 13/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActHi.kicad_sch

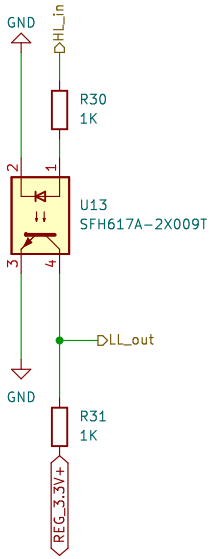
Title: Active Hi Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 14/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActHi.kicad_sch

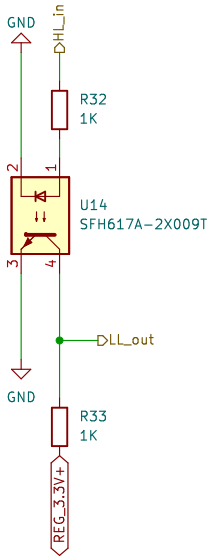
Title: Active Hi Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 15/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation



https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActHi.kicad_sch

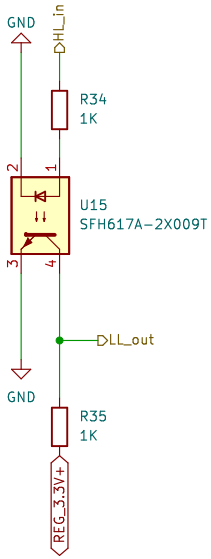
Title: Active Hi Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 16/31

SFH617A-2X009T
CTR 63-125%
Vf = 1.35V

Circuit CTR:
If = (12V-1.35V)/1K = 10.65mA
Ic = 3.3/1K = 3.3mA
CTRc = 3.3/10.65 = 30.9%

Opto is always in saturation

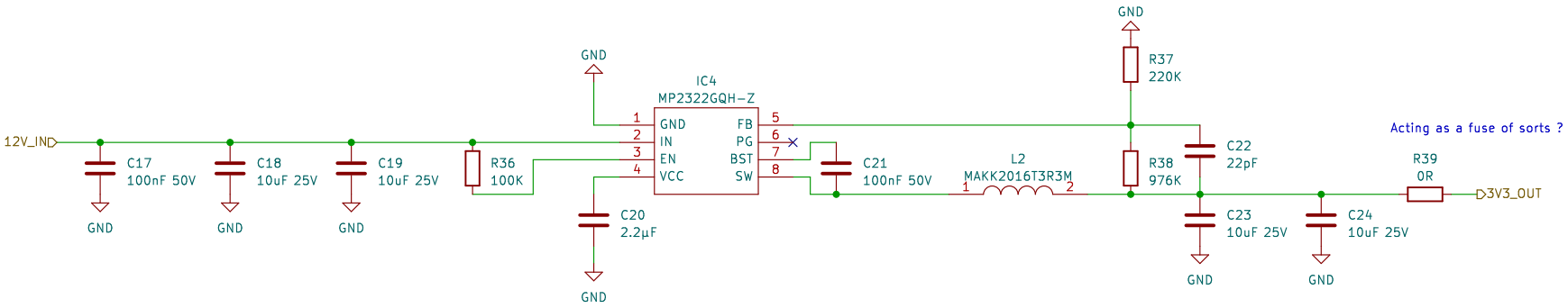


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActHi.kicad_sch

Title: Active Hi Optocoupler circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 17/31

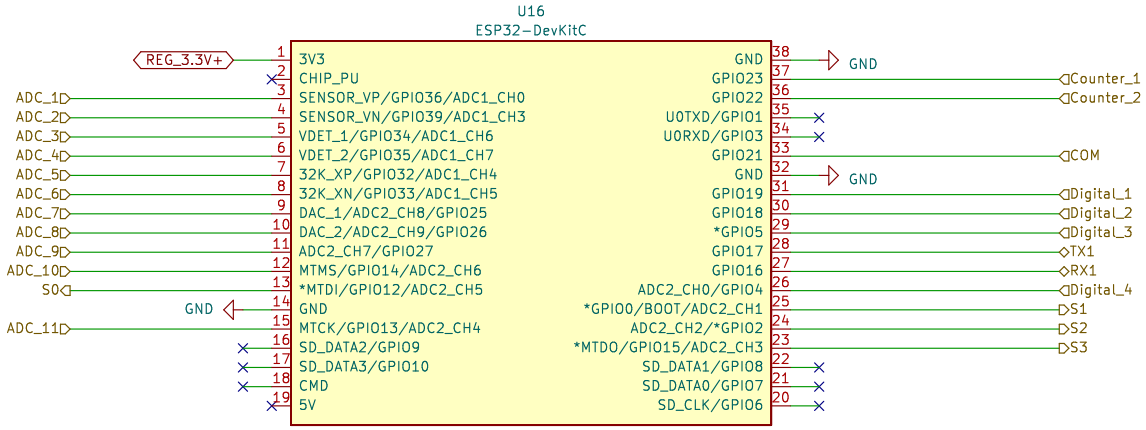


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: 12V_to_3V3_MP2322GQH.kicad_sch

Title: 5 to 3V3 stage

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 18/31

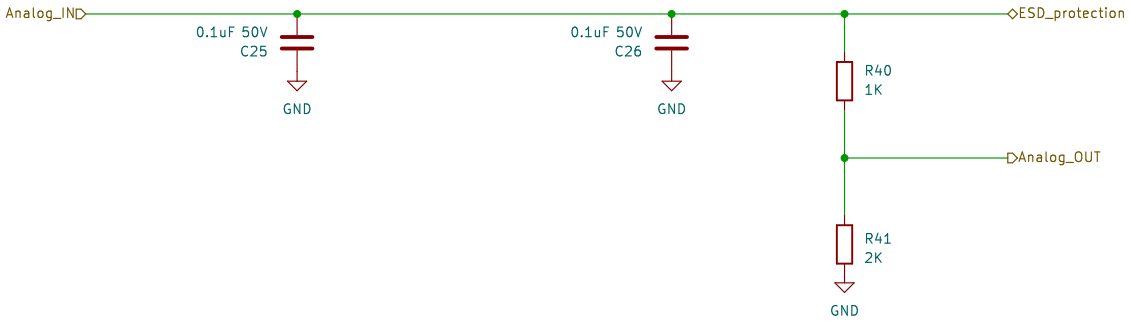


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: ESP32.kicad_sch

Title: ESP32 container

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 19/31

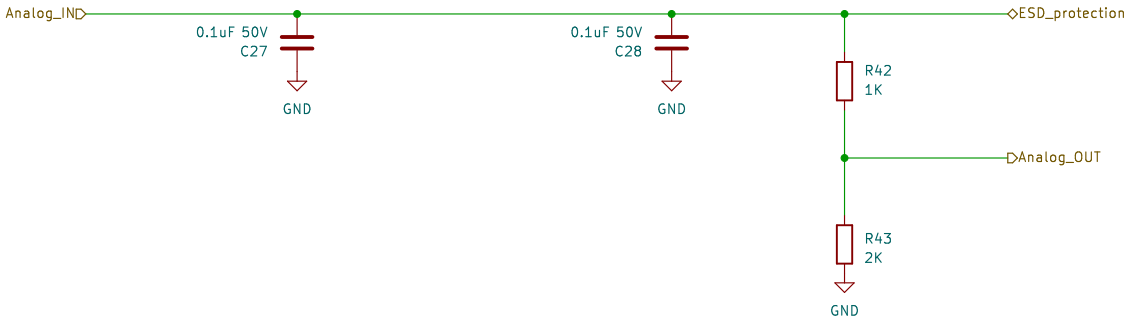


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogV_Divider.kicad_sch

Title: 0-5V voltage sensing circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 20/31

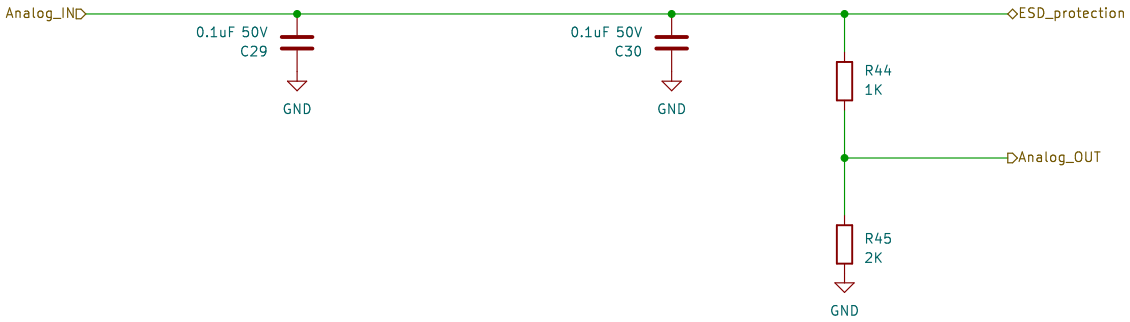


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogV_Divider.kicad_sch

Title: 0-5V voltage sensing circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 21/31

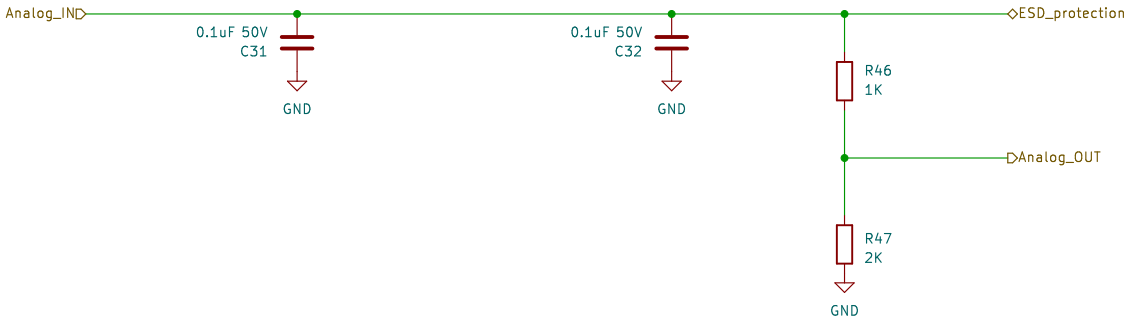


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogV_Divider.kicad_sch

Title: 0-5V voltage sensing circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 22/31



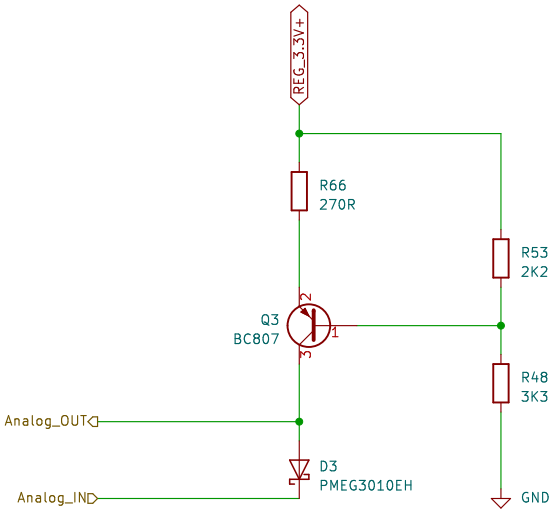
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogV_Divider.kicad_sch

Title: 0-5V voltage sensing circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 23/31

Needs separate calibration
Valid only for 0-250Ohm, maybe a bit more



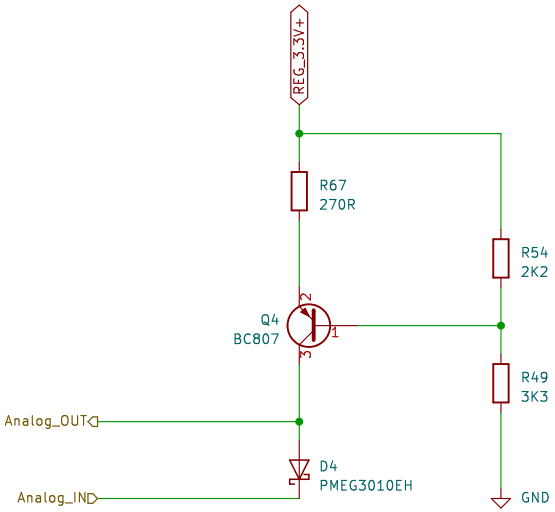
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogR_Divider.kicad_sch

Title: Low R sensing circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 24/31

Needs separate calibration
Valid only for 0-250Ohm, maybe a bit more



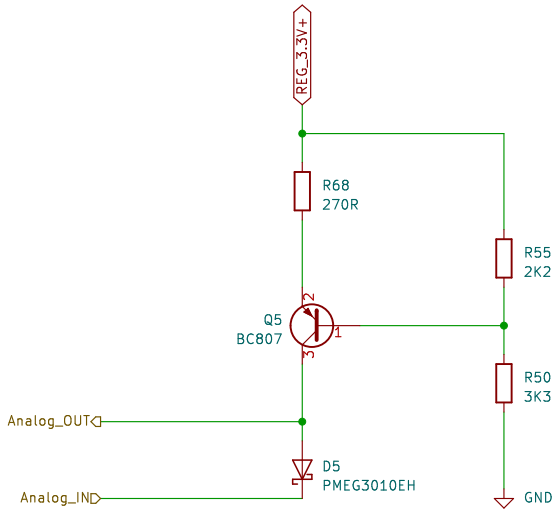
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogR_Divider.kicad_sch

Title: Low R sensing circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 25/31

Needs separate calibration
Valid only for 0-250Ohm, maybe a bit more



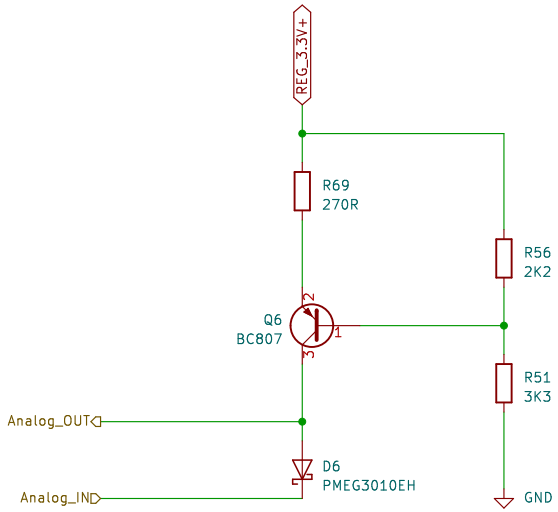
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogR_Divider.kicad_sch

Title: Low R sensing circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 26/31

Needs separate calibration
Valid only for 0-250Ohm, maybe a bit more



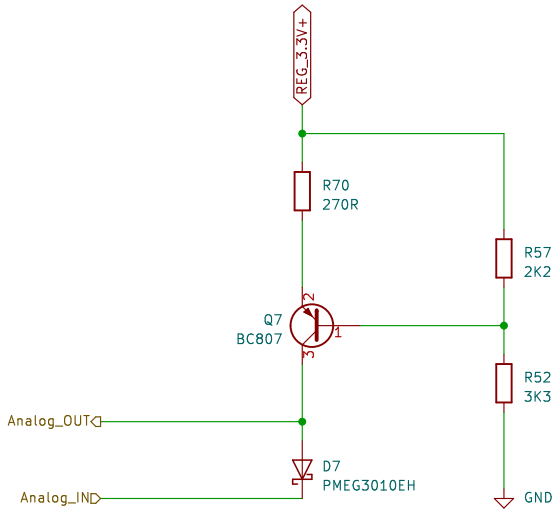
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogR_Divider.kicad_sch

Title: Low R sensing circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 27/31

Needs separate calibration
Valid only for 0-250Ohm, maybe a bit more

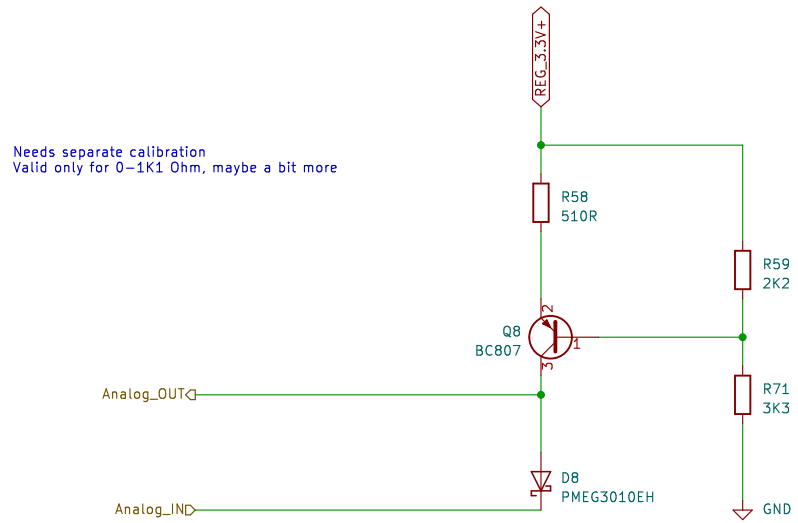


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogR_Divider.kicad_sch

Title: Low R sensing circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 28/31



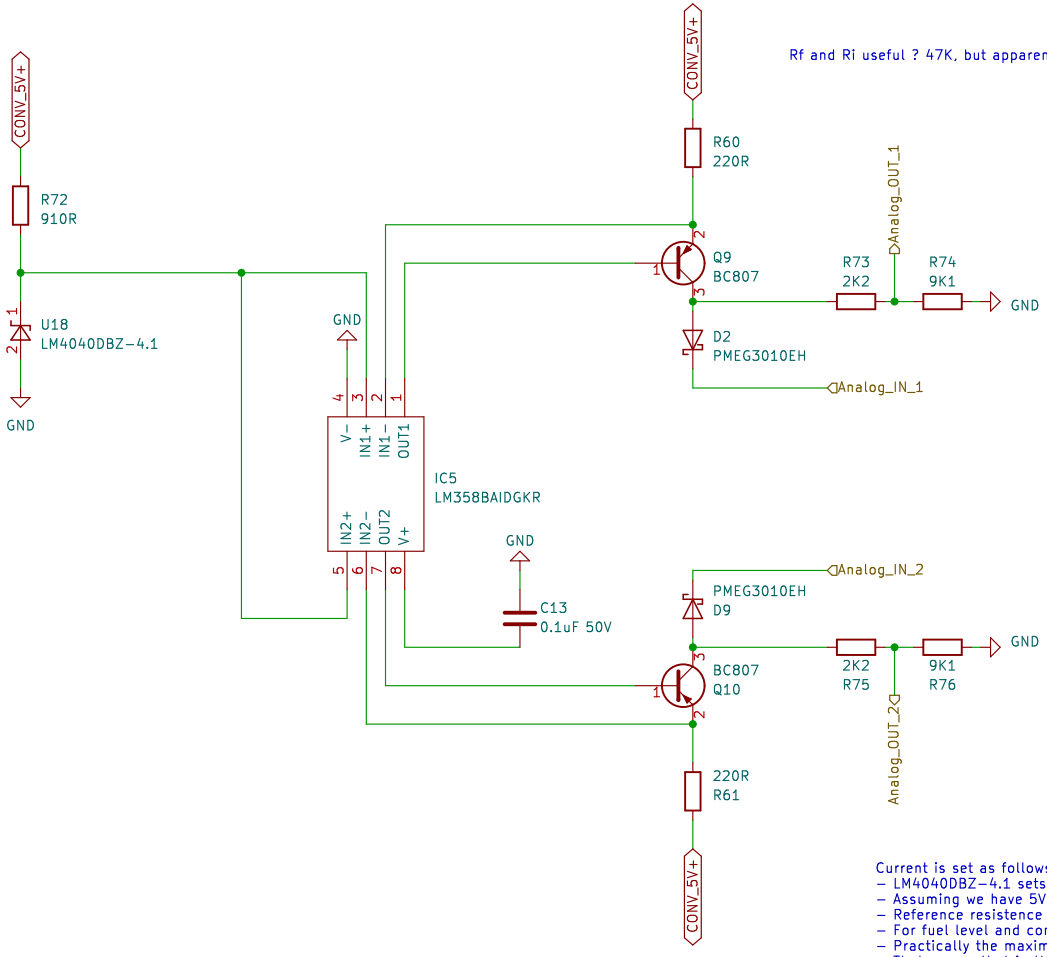
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogR_Divider_HiR.kicad_sch

Title: High R sensing circuit

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 29/31

Ideas/issues :
- How to account for variations in the Vf of PMEG3010EH
- 5V may not be true 5V -> Zener regulator there too ? evaluate possible swings
- Design is a bit limited to be usable on >750Ohm sensors like ECU sensors
- Something better than PMEG3010EH to use ?



Rf and Ri useful ? 47K, but apparently LM358B/BA integrates Rf and Ri

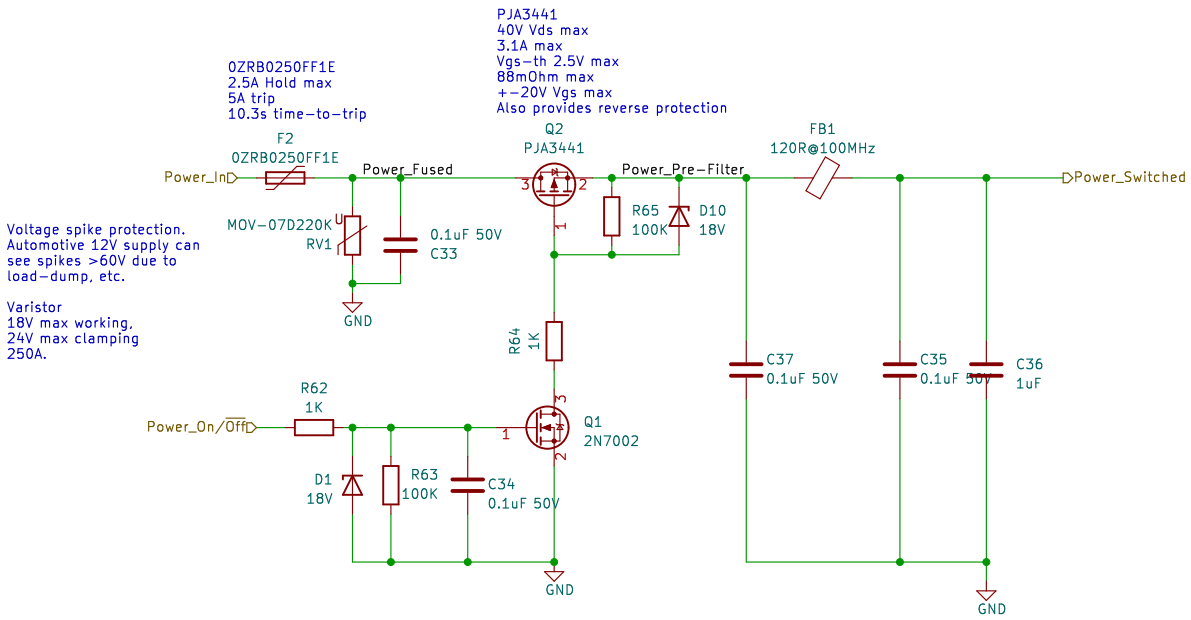
Current is set as follows :
- LM4040DBZ-4.1 sets voltage at 4.096V on a good day
- Assuming we have 5V this makes a reference voltage of 0.904V
- Reference resistence is currently 220R -> Reference current is 0.904/220 = 4.1mA approx
- For fuel level and common sensors (0-2500hm), that gives a sensor voltage of anywhere between 0 and 1.025V
- Practically the maximum voltage that can be is 4.096V-0.550V = 3.546 (the schottky typical Vf, although usually lower)
- That means that in this current setup the practical limit for sensor resistance readout is approximately 800 to 8500hm
- There is a 4.1 -> 3.3V divider for the ESP32 ADC using the 2K2 and 9K1 resistors

https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Rsensing_Pair.kicad_sch

Title: Dual Op-Amp Constant current source resistive sensor

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 31/31



TODO: Look at load disconnect options if needed?

https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Power_Input.kicad_sch

Title: Power switching and protection

Size: A4	Date: 2023-05-01	**Rev: 1.2**
KiCad E.D.A. kicad (7.0.0)		Id: 31/31