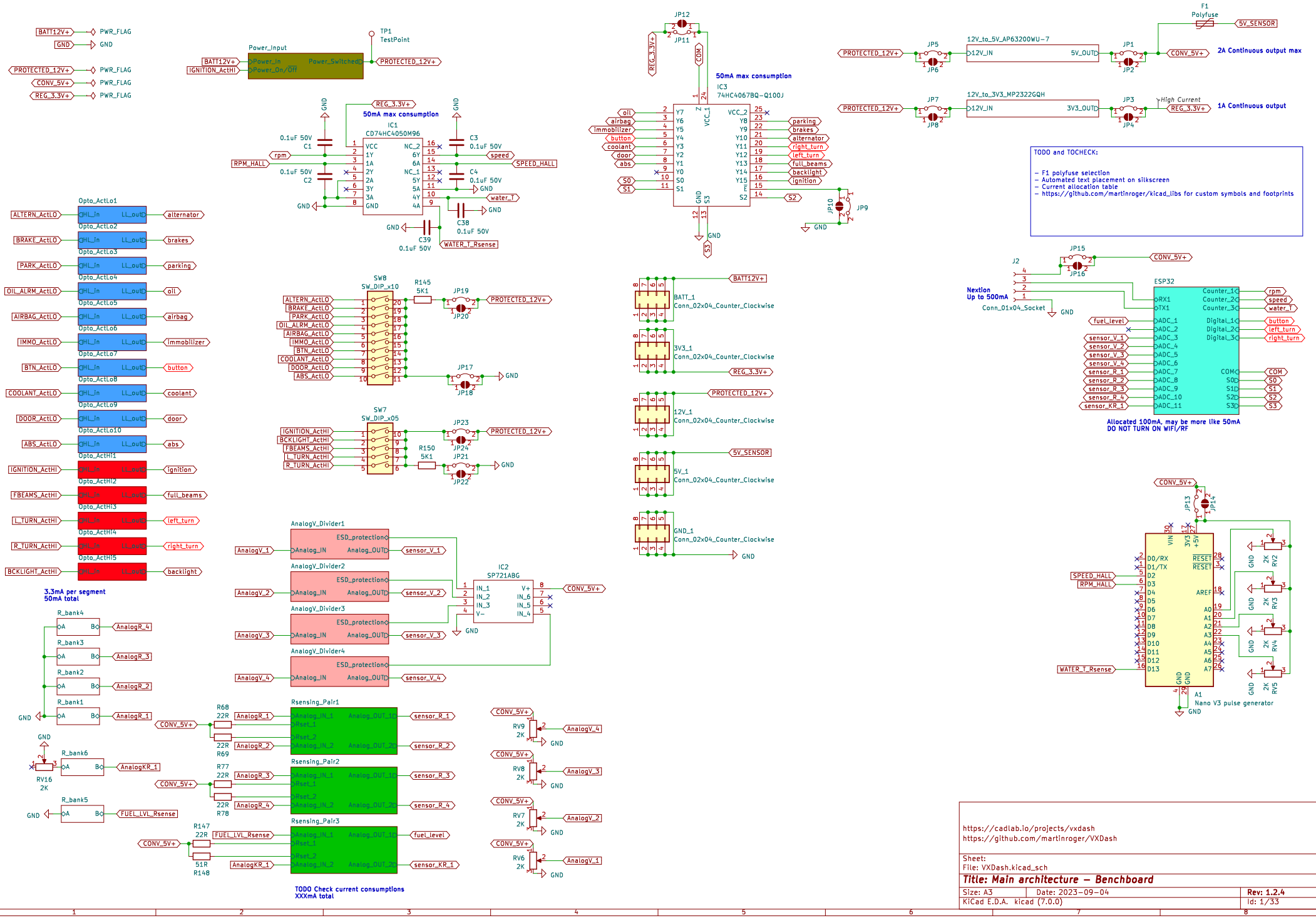
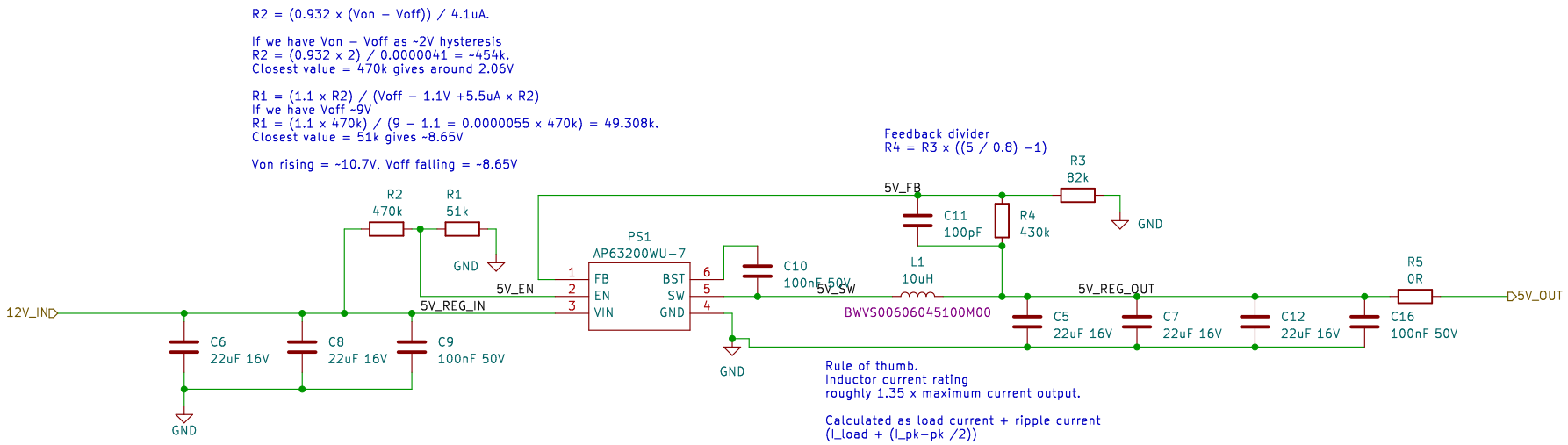

PWR_FLAG
GND
TP1
TestPoint
Power_Input
Power_Switched
IC1
CD74HC4050M96
50mA max consumption
IC3
74HC4067BQ-Q100J
50mA max consumption
F1
Polyfuse
5V_SENSOR
12V_to_5V_AP63200WU-7
2A Continuous output max
12V_to_3V3_MP2322GQH
1A Continuous output
High Current
TODO and TOCHECK:
- F1 polyfuse selection
- Automated text placement on silkscreen
- Current allocation table
- https://github.com/martinroger/kicad_libs for custom symbols and footprints
Opto_ActLo1
Opto_ActLo2
Opto_ActLo3
Opto_ActLo4
Opto_ActLo5
Opto_ActLo6
Opto_ActLo7
Opto_ActLo8
Opto_ActLo9
Opto_ActLo10
Opto_ActHI1
Opto_ActHI2
Opto_ActHI3
Opto_ActHI4
Opto_ActHI5
3.3mA per segment
50mA total
SW8
SW_DIP_x10
SW7
SW_DIP_x05
ESP32
Nextion
Up to 500mA
Allocated 100mA, may be more like 50mA
DO NOT TURN ON WIFI/RF
Nano V3 pulse generator
AnalogV_Divider1
AnalogV_Divider2
AnalogV_Divider3
AnalogV_Divider4
ESD_protection
Analog_IN
Analog_OUT
IC2
SP721ABG
Rsensing_Pair1
Rsensing_Pair2
Rsensing_Pair3
R_bank1
R_bank2
R_bank3
R_bank4
R_bank5
R_bank6
TODO Check current consumptions
XXXmA total
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash
Sheet:
File: VXDash.kicad_sch
Title: Main architecture – Benchboard
Size: A3
Date: 2023-09-04
KiCad E.D.A. kicad (7.0.0)
Rev: 1.2.4
Id: 1/33



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

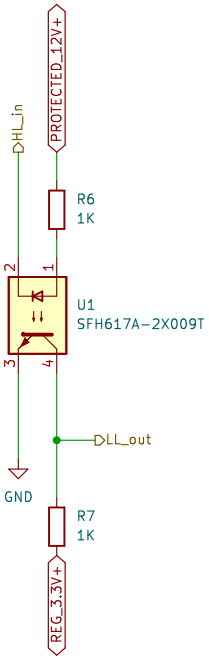
Title: 12V to 5V conversion

Size: A4	Date: 2023−09−04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 2/33

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

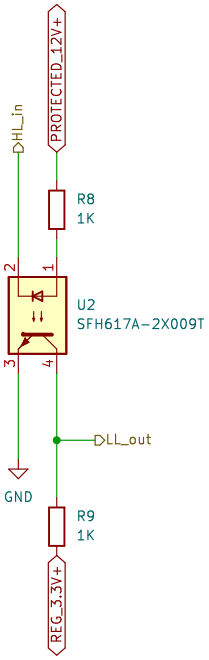
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 3/33

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

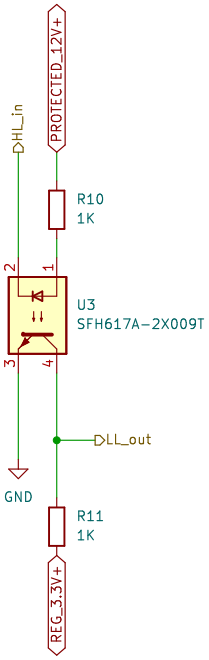
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 4/33

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

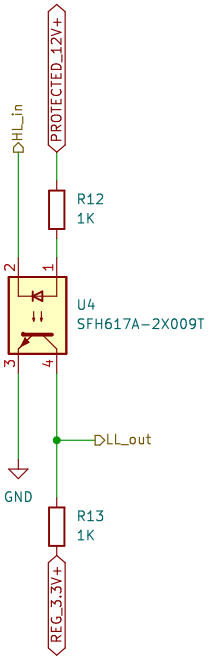
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 5/33

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

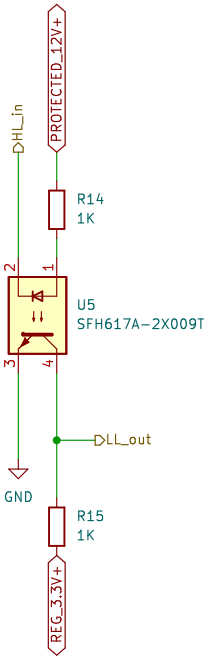
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 6/33

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

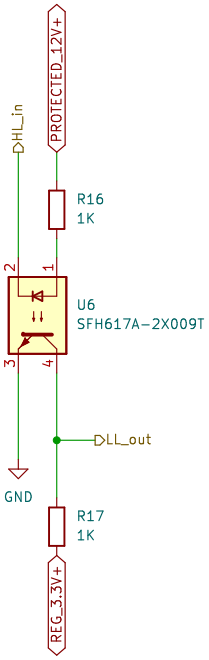
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 7/33

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

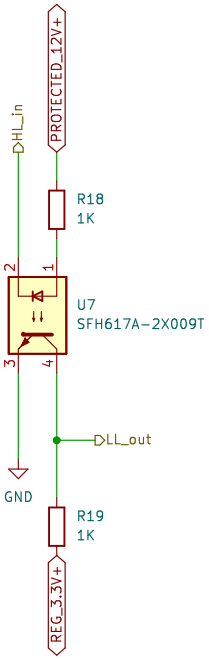
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 8/33

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

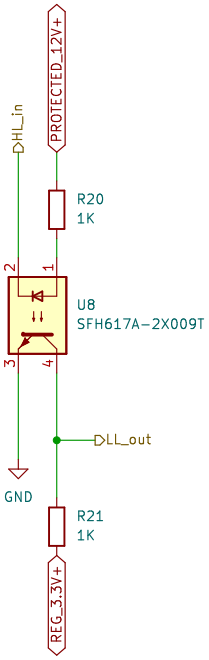
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 9/33

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

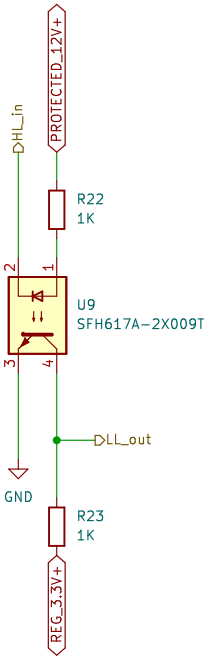
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 10/33

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

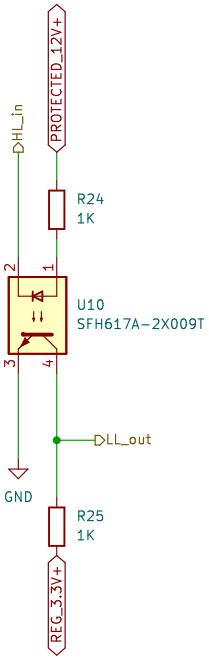
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 11/33

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

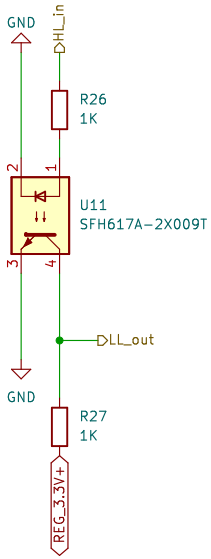
Title: Active Low Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 12/33

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

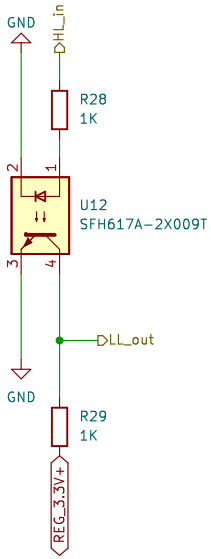
Title: Active Hi Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 13/33

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

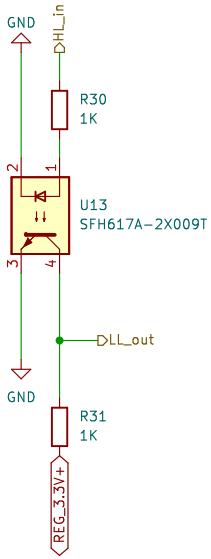
Title: Active Hi Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 14/33

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

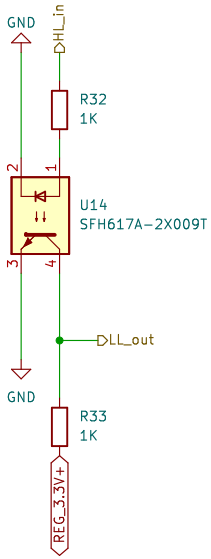
Title: Active Hi Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 15/33

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

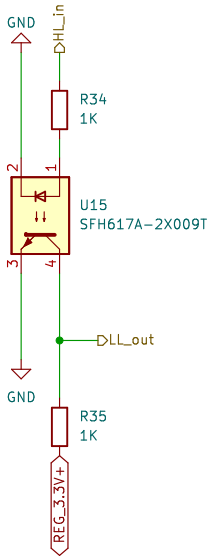
Title: Active Hi Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 16/33

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

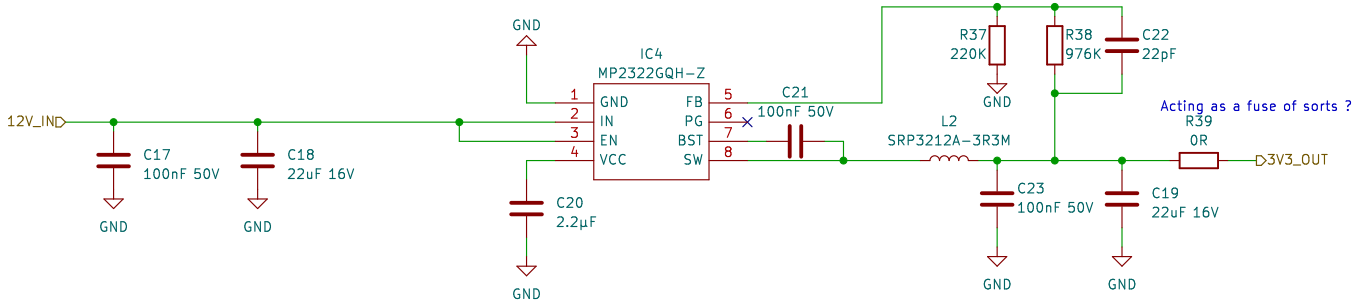


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Opto_ActHi.kicad_sch

Title: Active Hi Optocoupler circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 17/33

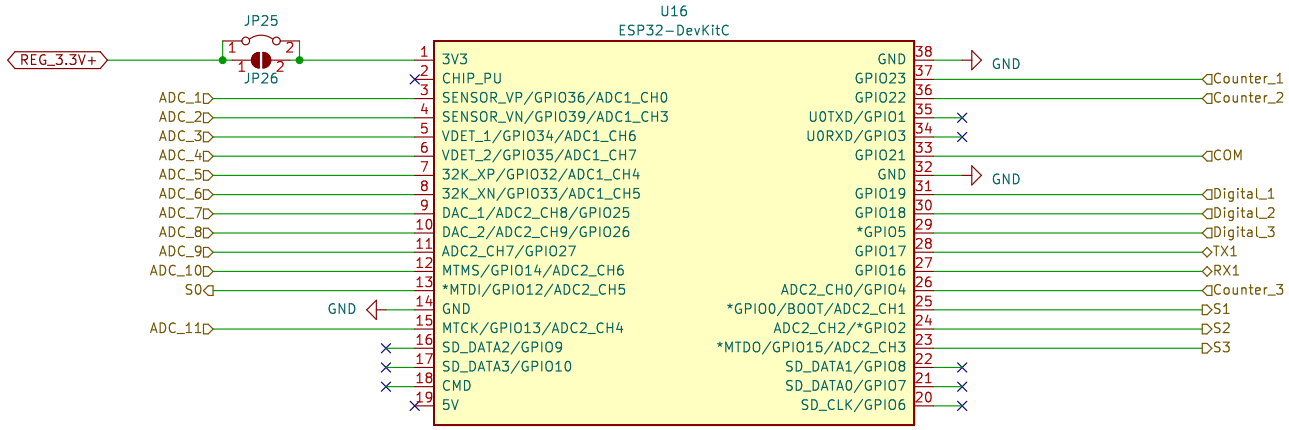


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: 12V_to_3V3_MP2322GQH.kicad_sch

Title: 5 to 3V3 stage

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 18/33

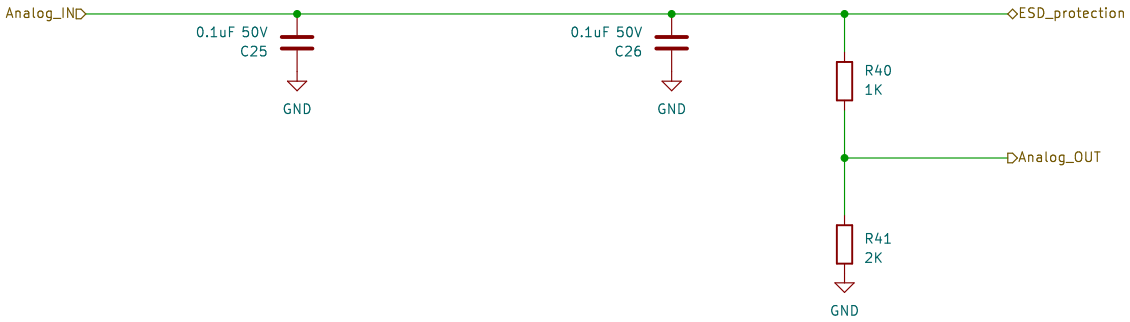


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: ESP32.kicad_sch

Title: ESP32 container

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 19/33

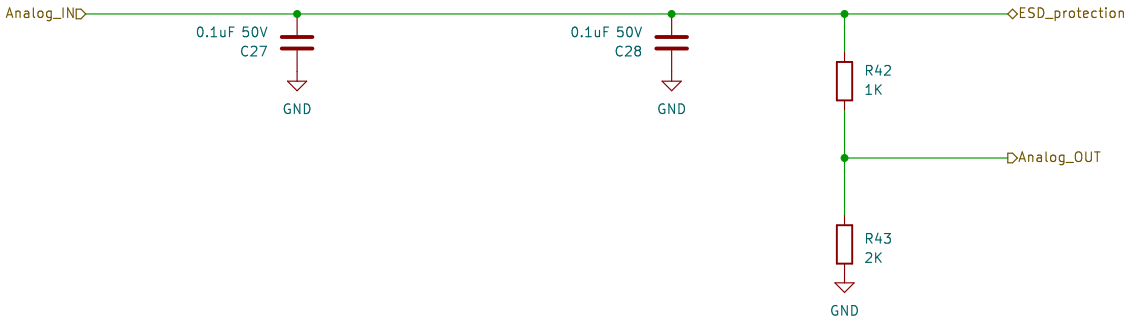


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogV_Divider.kicad_sch

Title: 0-5V voltage sensing circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 20/33

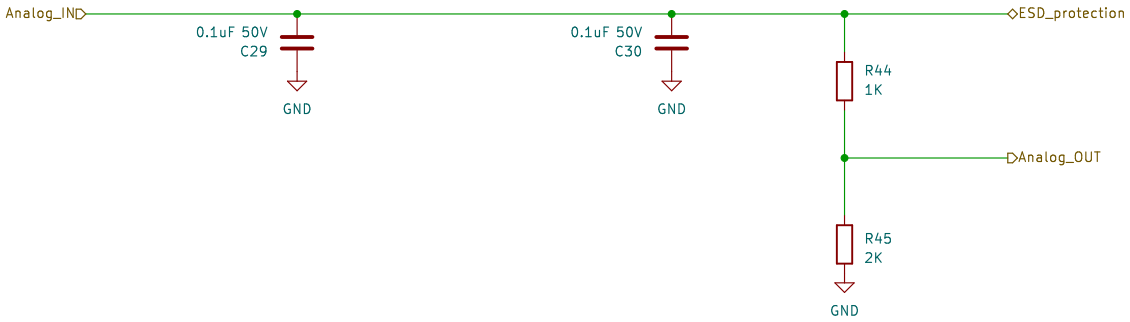


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogV_Divider.kicad_sch

Title: 0-5V voltage sensing circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 21/33

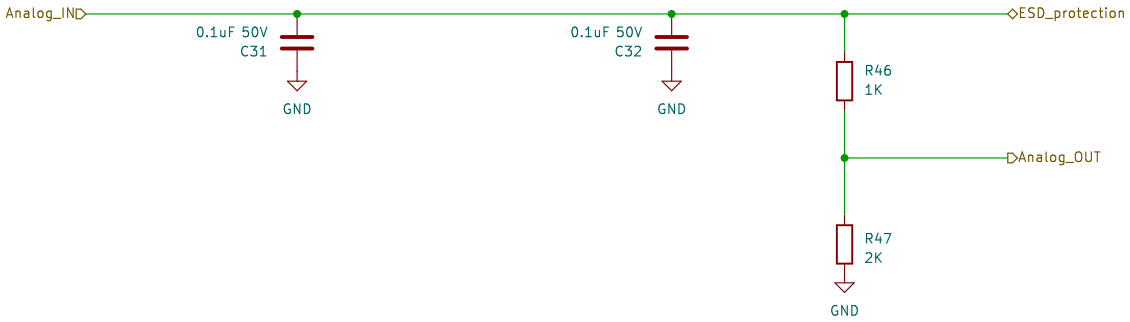


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogV_Divider.kicad_sch

Title: 0-5V voltage sensing circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 22/33



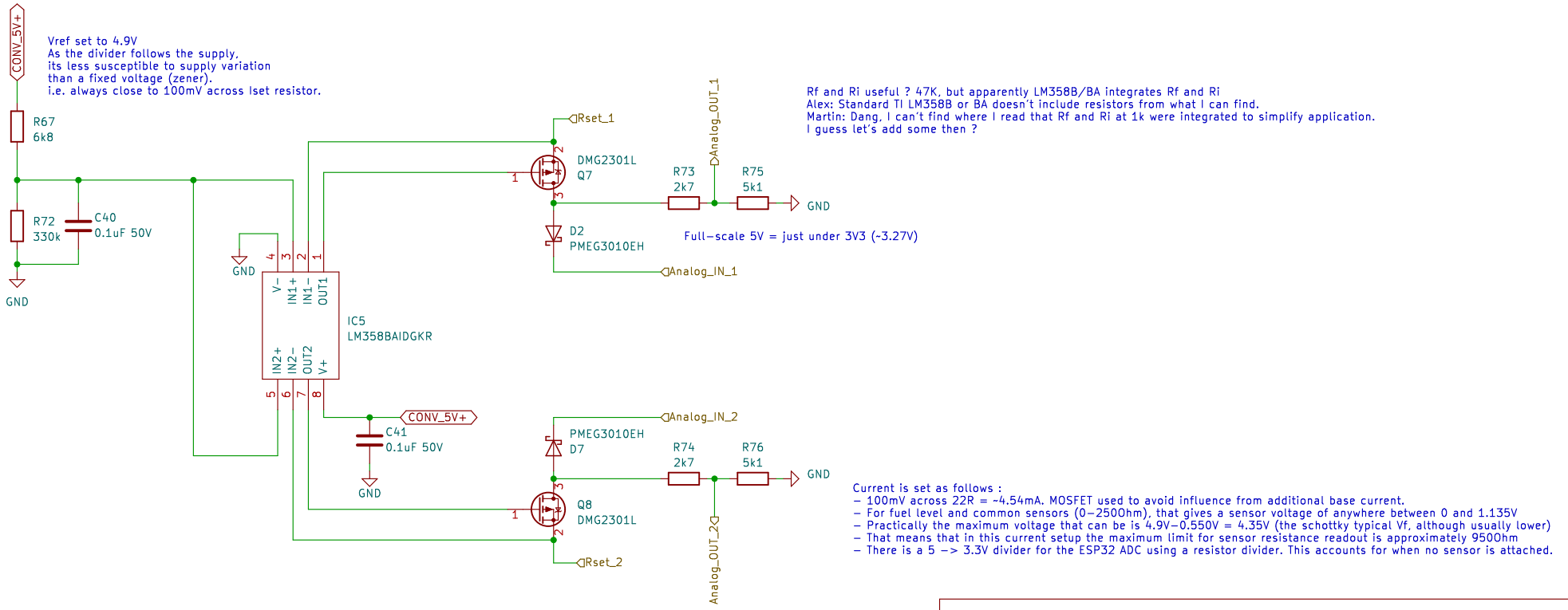
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: AnalogV_Divider.kicad_sch

Title: 0-5V voltage sensing circuit

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 23/33

Ideas/issues :
- How to account for variations in the Vf of PMEG3010EH
  Alex: At ~4.5mA, Vf varies by ~120mV from −40 to 80degC. This equates to ~24ohm error over a large temp
- 5V may not be true 5V −> Zener regulator there too ? evaluate possible swings
  Alex: Used a Vref that follows any variation of 5V. More worried about keeping a set V across the current set resistor.
- Design is a bit limited to be usable on >750ohm sensors like ECU sensors
  Alex: Could be used for sensors up to 900ohm. We could look to add configurable range switchig future versions.
  Martin : Currently I am reserving one I/O for higher impedance sensors. I guess increasing the Iset resistor is also a method, for example to 51R?
- Something better than PMEG3010EH to use ?
  Alex: At ~4.5mA, Vf is only ~200mV which is pretty good!
- No issue with Vset being so close to the Vcc for the LM358? I got a bit confused by the datasheet.



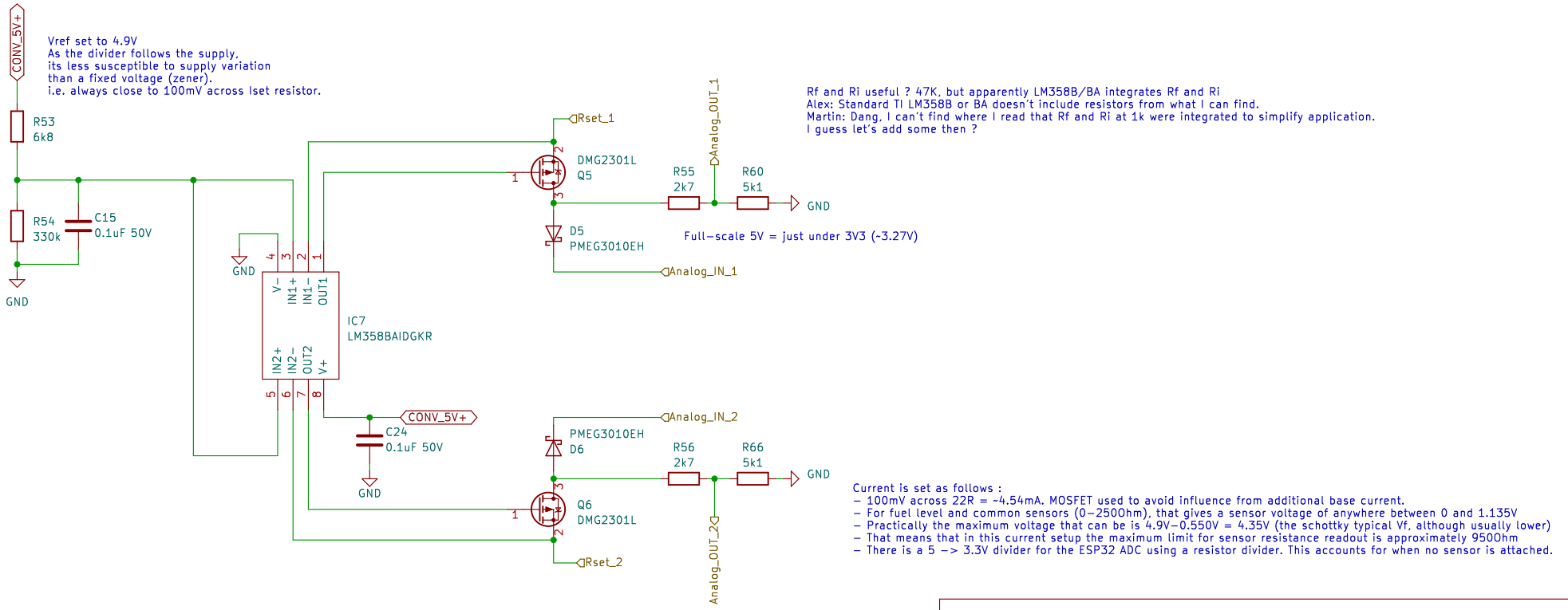
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Rsensing_Pair.kicad_sch

Title: Dual Op−Amp Constant current source resistive sensor

Size: A4	Date: 2023−09−04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 24/33

Ideas/issues :
- How to account for variations in the Vf of PMEG3010EH
  Alex: At ~4.5mA, Vf varies by ~120mV from −40 to 80degC. This equates to ~24ohm error over a large temp
- 5V may not be true 5V −> Zener regulator there too ? evaluate possible swings
  Alex: Used a Vref that follows any variation of 5V. More worried about keeping a set V across the current set resistor.
- Design is a bit limited to be usable on >750ohm sensors like ECU sensors
  Alex: Could be used for sensors up to 900ohm. We could look to add configurable range switchig future versions.
  Martin : Currently I am reserving one I/O for higher impedance sensors. I guess increasing the Iset resistor is also a method, for example to 51R?
- Something better than PMEG3010EH to use ?
  Alex: At ~4.5mA, Vf is only ~200mV which is pretty good!
- No issue with Vset being so close to the Vcc for the LM358? I got a bit confused by the datasheet.

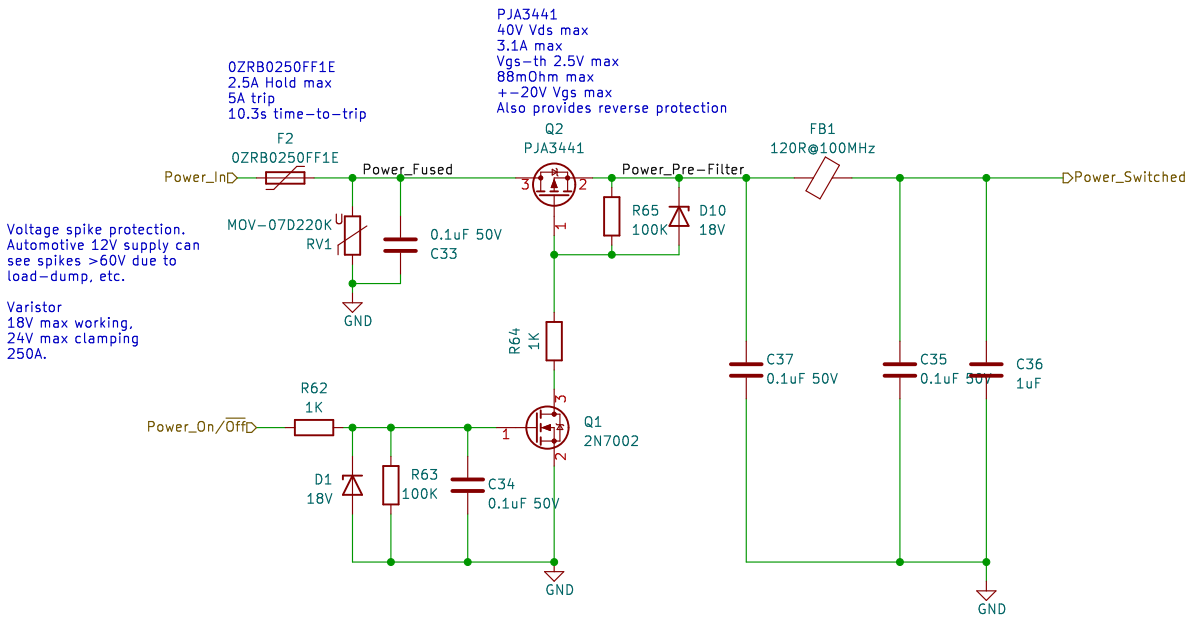


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Rsensing_Pair.kicad_sch

Title: Dual Op−Amp Constant current source resistive sensor

Size: A4	Date: 2023−09−04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 25/33



TODO: Look at load disconnect options if needed?

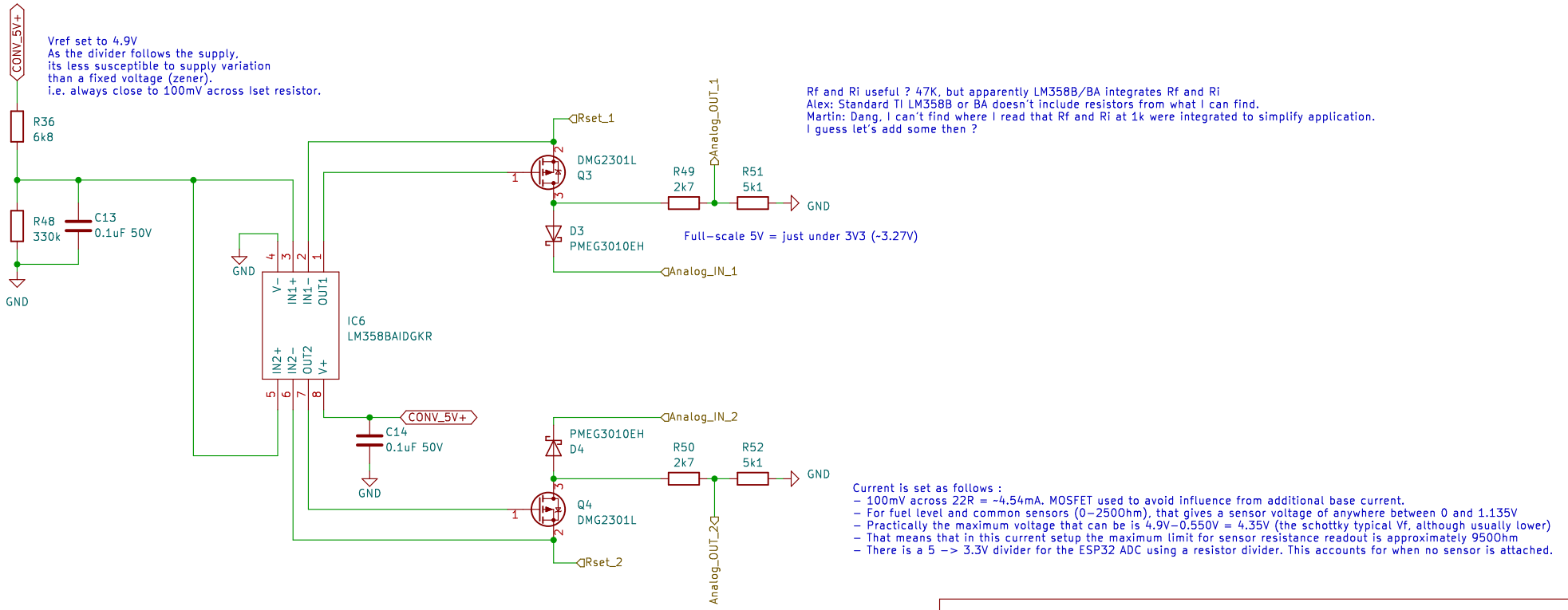
https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Power_Input.kicad_sch

Title: Power switching and protection

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 26/33

Ideas/issues :
- How to account for variations in the Vf of PMEG3010EH
  Alex: At ~4.5mA, Vf varies by ~120mV from −40 to 80degC. This equates to ~24ohm error over a large temp
- 5V may not be true 5V −> Zener regulator there too ? evaluate possible swings
  Alex: Used a Vref that follows any variation of 5V. More worried about keeping a set V across the current set resistor.
- Design is a bit limited to be usable on >750ohm sensors like ECU sensors
  Alex: Could be used for sensors up to 900ohm. We could look to add configurable range switchig future versions.
  Martin : Currently I am reserving one I/O for higher impedance sensors. I guess increasing the Iset resistor is also a method, for example to 51R?
- Something better than PMEG3010EH to use ?
  Alex: At ~4.5mA, Vf is only ~200mV which is pretty good!
- No issue with Vset being so close to the Vcc for the LM358? I got a bit confused by the datasheet.

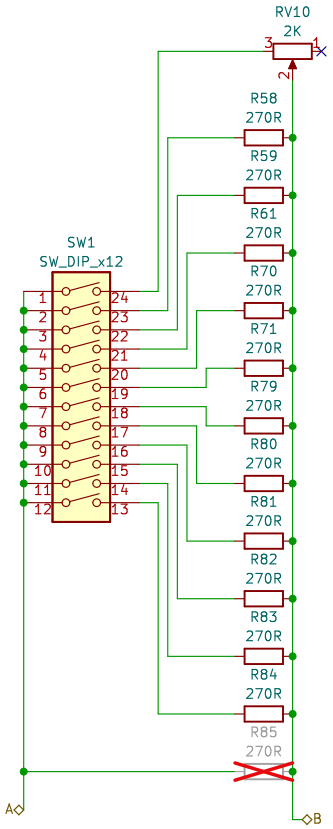


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: Rsensing_Pair.kicad_sch

Title: Dual Op−Amp Constant current source resistive sensor

Size: A4	Date: 2023−09−04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 27/33

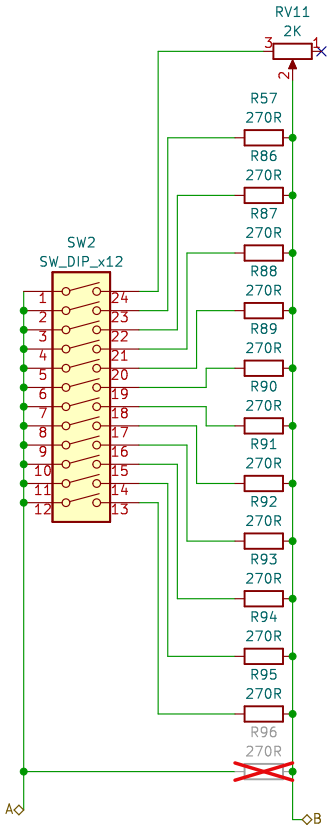


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: R_bank.kicad_sch

Title: 270R divider

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 28/33

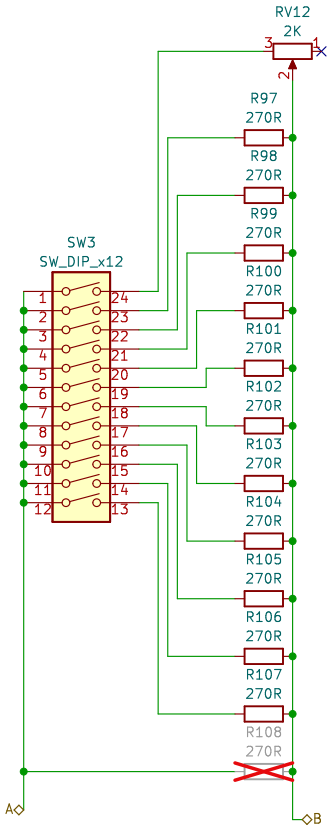


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: R_bank.kicad_sch

Title: 270R divider

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 29/33

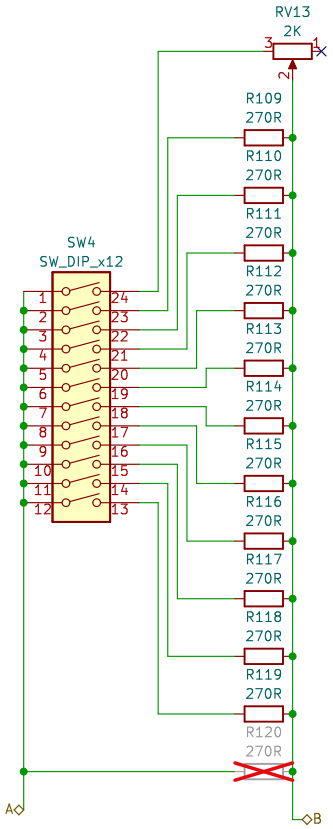


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: R_bank.kicad_sch

Title: 270R divider

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 30/33

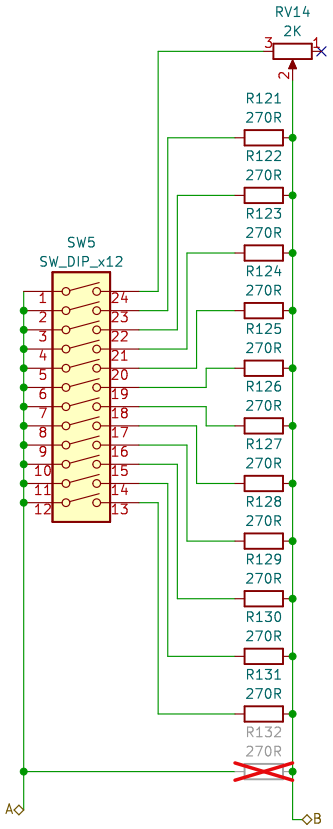


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: R_bank.kicad_sch

Title: 270R divider

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 31/33

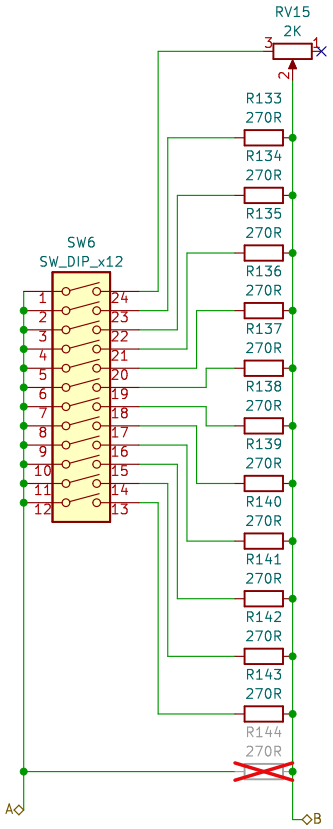


https://cadlab.io/projects/vxdash
https://github.com/martinroger/VXDash

Sheet:
File: R_bank.kicad_sch

Title: 270R divider

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 32/33



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

Sheet:
File: R_bank.kicad_sch

Title: 270R divider

Size: A4	Date: 2023-09-04	**Rev: 1.2.4**
KiCad E.D.A. kicad (7.0.0)		Id: 33/33