

LC Charger Stabilizer

This circuit is designed as a protection and control board for the Indigo Lower Cost Charger. It contains a disconnect and associated control, as well as enhanced impulsive transient protection. A heater controller is also included.

Please refer to the description of the motivations and operation of the protection circuit, which should be part of the materials of this package. If you did not receive these materials, the whole package may be downloaded from <https://docs.2to8.cc>.

The protection page calls out two different sets of resistor choices that set the cut-in and cut-out levels of the disconnect. These are chosen to be compatible with the input voltage ranges for 230V/50-60 Hz voltage stabilizers (both standard and extended range) described in the World Health Organization performance specification WHO/PQS/E007/VS01.6 (2022), available at <https://extranet.who.int/prequal/immunization-devices/performance-specifications>. Note that only the standard range works well with a single heater design such as this one.

License

Copyright 2025 New Horizons, a division of Global Health Labs

This source (schematic, PCB layout, BOM, and other associated files) describes Open Hardware and is licensed under the CERN-OHL-P v2.

You may redistribute and modify this documentation and make products using it under the terms of the CERN-OHL-P v2 (<https://cern.ch/cern-ohl>). This documentation is distributed WITHOUT ANY EXPRESS OR IMPLIED WARRANTY, INCLUDING OF MERCHANTABILITY, SATISFACTORY QUALITY AND FITNESS FOR A PARTICULAR PURPOSE. Please see the CERN-OHL-P v2 for applicable conditions.

Connectivity

Hierarchical design (ports are sheet connectors, power ports are global, but net labels are local to the sheet)

Power port names take priority if they are attached to a net.

Net Classes

-   FG
- Functional Ground (Earth, when present)
-  L1
- Line
- Line before over/under protection relay
-  L2
- LineProt
- Line after over/under protection relay
-  N1
- Neut
- Neutral, from Power In to Heater and AC/DC Converter

PCB spacings between net classes

		mm
HV	to PE	4.0
Line	to Neut	3.0
Line	to LineProt	3.0
LineProt	to Neut	1.5

4mm, 3mm, and 1.5mm spacings were determined based on IEC 60335.

Assumptions:

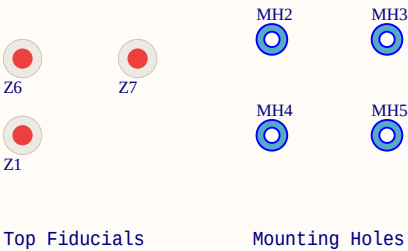
- IEC Class I (reinforced insulation)
- Pollution Degree 3
- Overvoltage category II (240V)

Revisions

Rev. 1.0: Initial board build, forked from Voltage Protection Module Rev. 1.1.

Rev. 1.1: Hand-modification changing R30 to 47.5k, as originally intended.

Rev. 1.2: Added a few comments and changed default build quantity to 100 pcs.

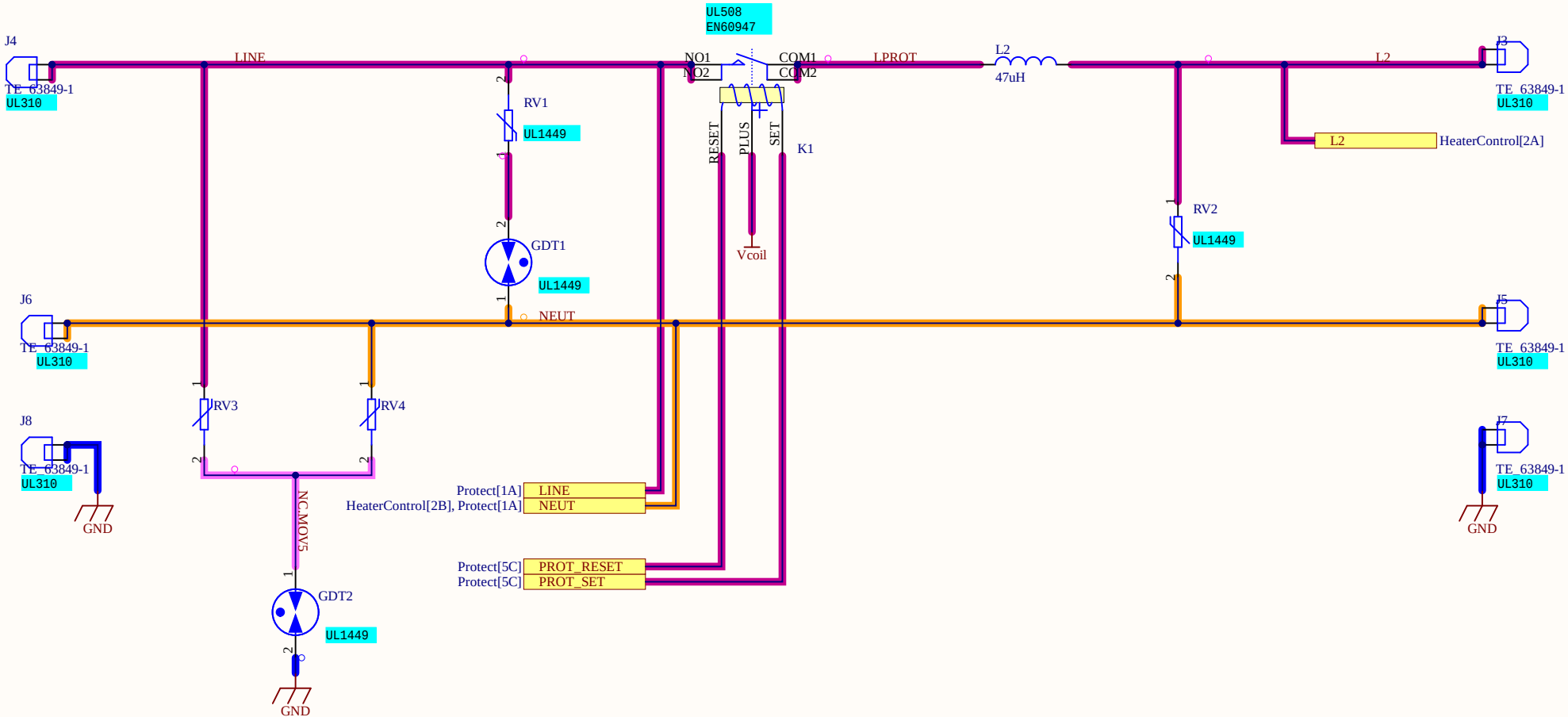


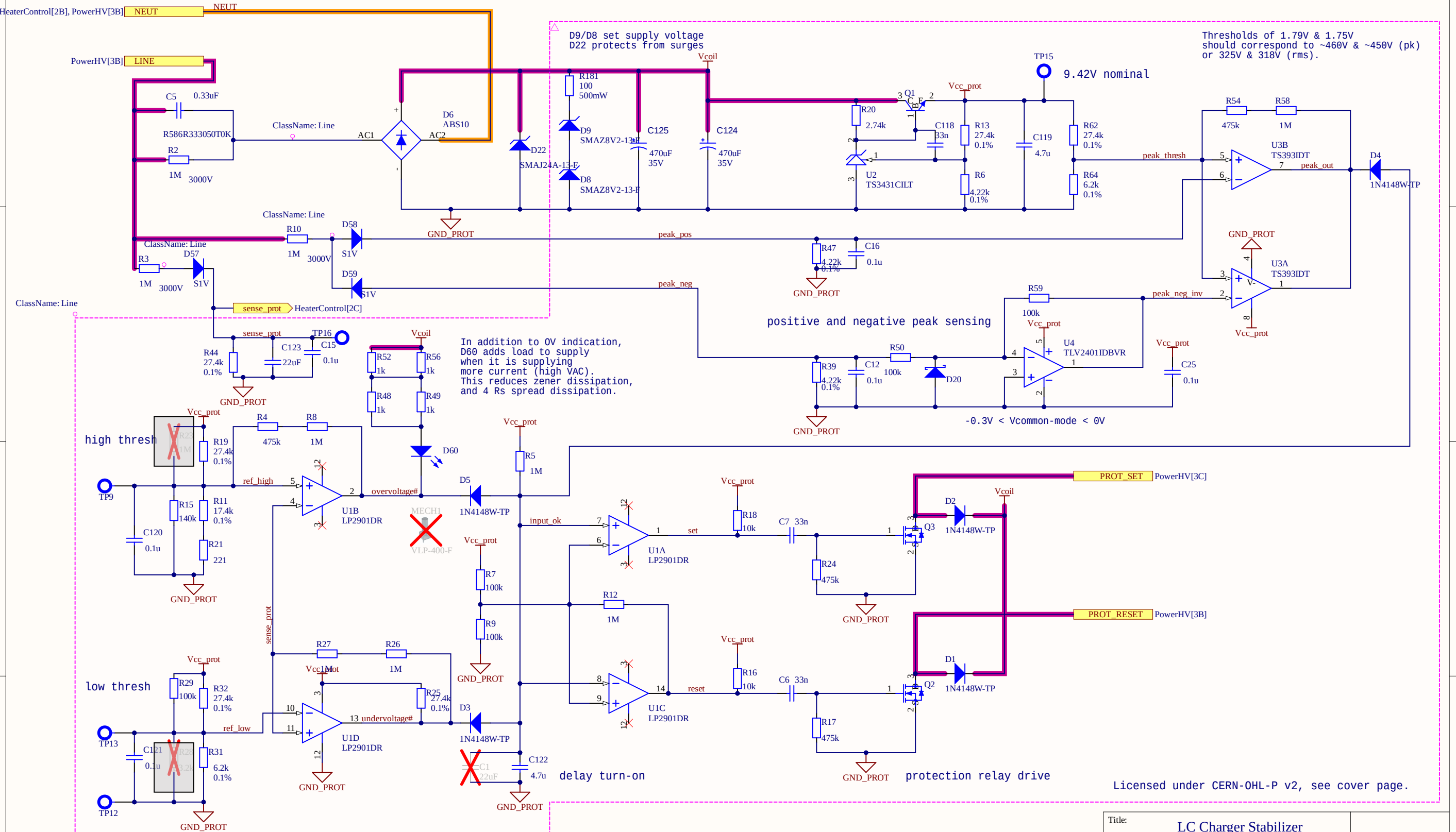
Title: LC Charger Stabilizer			
Size: B	Sheet: Cover Page	Revision: 1.2	
Date: 7/27/2025	Sheet 1 of 4	Drawn by: Rod Hinman, Todd Leshner	
File: Cover.SchDoc			

Text with this color background denotes safety standards that apply to the nearby component. This can aid in assembling a regulatory submission package, though you should always double-check the validity of the data.

Licensed under CERN-OHL-P v2, see cover page.

Title:		LC Charger Stabilizer		
Size:	Sheet:	Revision:		
B	HV Power	1.2		
Date: 7/27/2025	Sheet 2 of 4	Drawn by: Rod Hinman, Todd Leshner		
File: PowerHV.SchDoc				





In addition to OV indication, D60 adds load to supply when it is supplying more current (high VAC). This reduces zener dissipation, and 4 Rs spread dissipation.

D9/D8 set supply voltage
D22 protects from surges

Thresholds of 1.79V & 1.75V should correspond to ~460V & ~450V (pk) or 325V & 318V (rms).

positive and negative peak sensing

-0.3V < Vcommon-mode < 0V

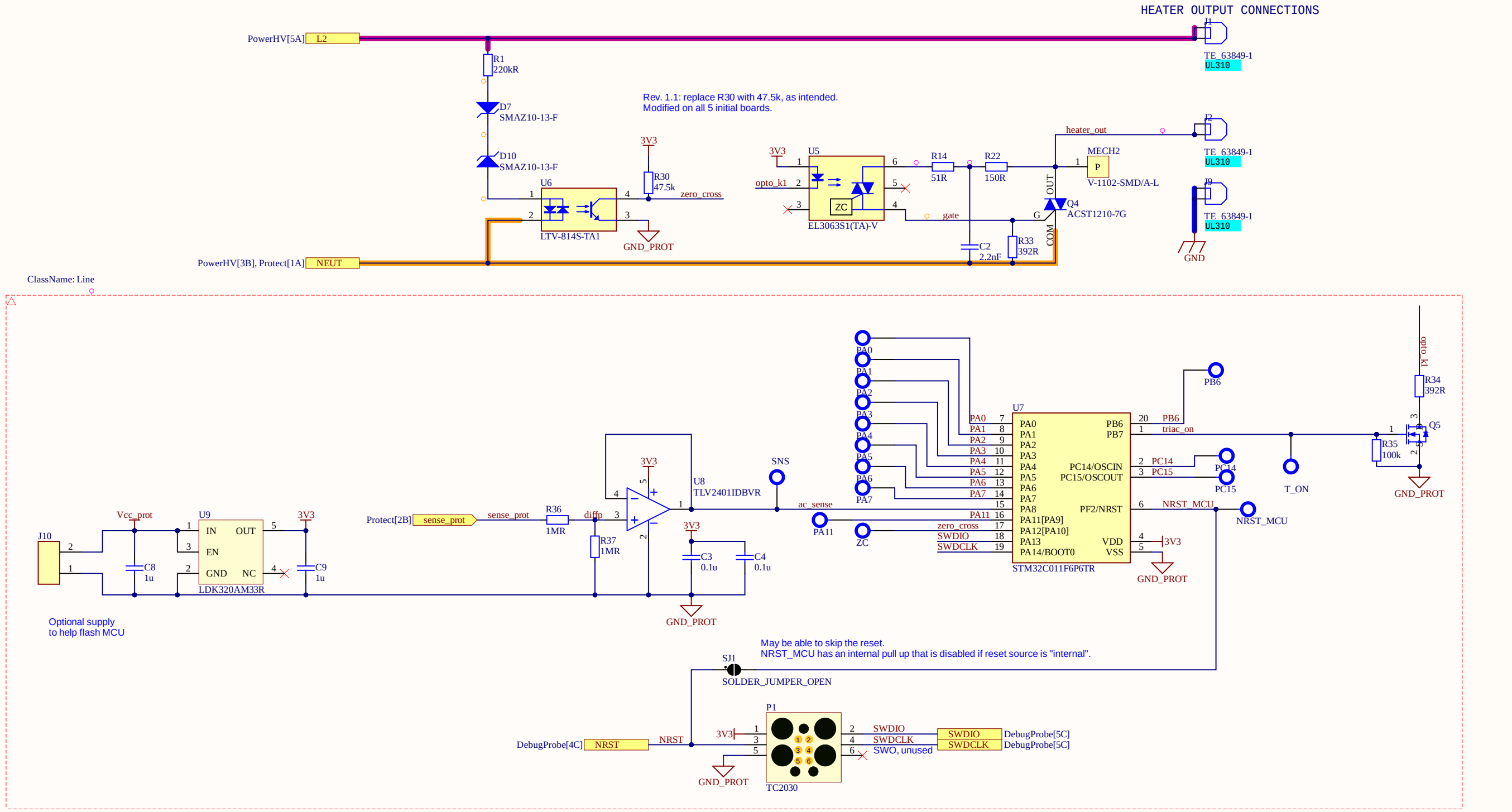
delay turn-on

protection relay drive

Licensed under CERN-OHL-P v2, see cover page.

Measured values from Rev. 1.0 PCB
Low cutoff for WHO PQS extended input range: R29=140k, R32=27.4k, R31=3.4k yields ref_low ~ 1.218V, or 87.3 V / 95.7 V.
Low cutoff for WHO PQS standard input range: R29=100k, R32=27.4k, R31=6.2k yields ref_low ~ 2.113V, or 162.0 V / 167 V.
R19=27.4k, R15=140k, R11+R21=17.4k+211 yields ref_high ~ 3.503V, or 273.3 V / 269 V.

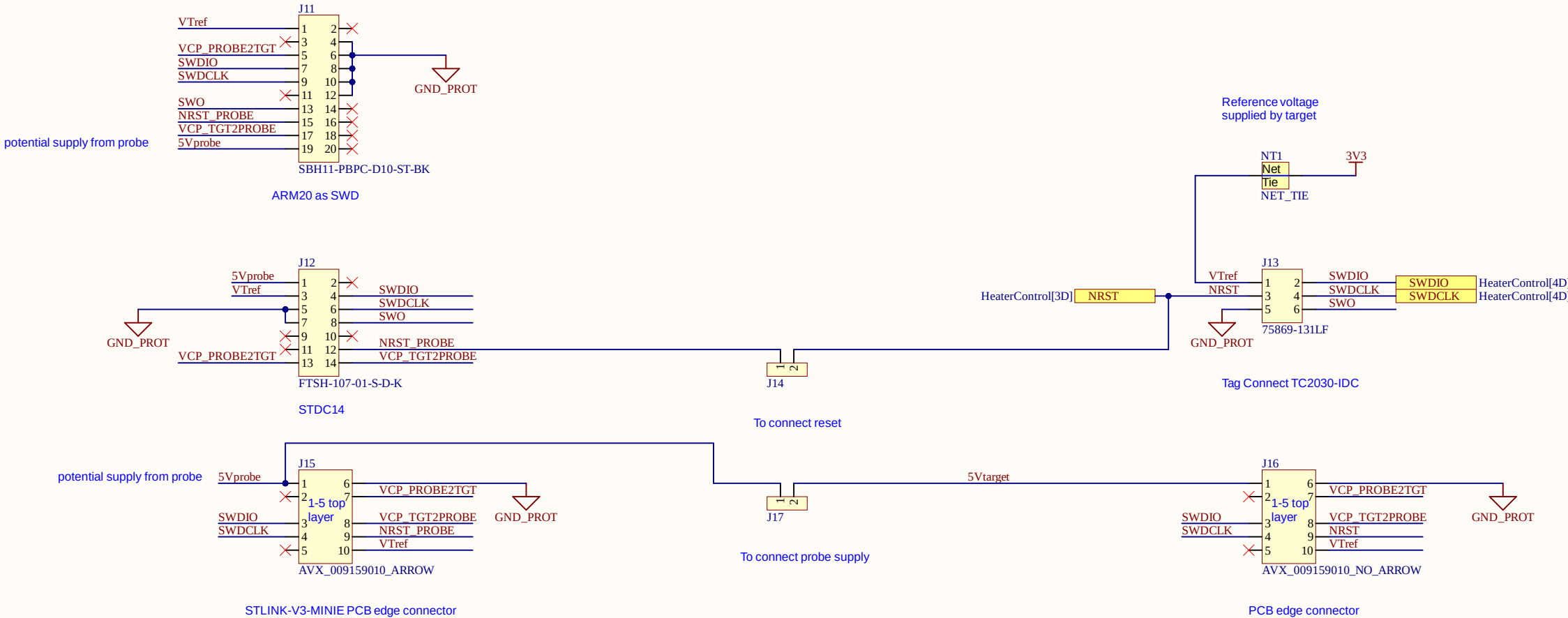
Title: LC Charger Stabilizer		
Size: B	Sheet: Protect	Revision: 1.2
Date: 7/27/2025	Sheet 3 of 4	Drawn by: Rod Hinman, Todd Leshner
File: Protect.SchDoc		



Licensed under CERN-OHL-P v2, see cover page.

Title: LC Charger Stabilizer		
Size: B	Sheet: Heater Control	Revision: 1.2
Date: 7/27/2025	Sheet 4 of 4	Drawn by: Rod Hinman, Todd Leshner
File: HeaterControl.SchDoc		

Several connection options to facilitate working with various debug probes



From debug probe

To target

Licensed under CERN-OHL-P v2, see cover page.

Title:		LC Charger Stabilizer	
Size:	B	Sheet:	DebugProbe
Date:	7/27/2025	Revision:	1.2
File:	DebugProbe.SchDoc	Drawn by:	Rod Hinman, Todd Leshner