

We have two possible current limits that we want to aim for depending on configuration. The limiting factory for power delivery at the moment is the connector between this board and the next; each conductor has a maximum rated current of 0.5A. If the hinges between the boards prove sufficiently reliable to carry our return current we can dedicate 6 of the 8 conductors for power delivery giving us a maximum of 3A. If not then we are limited to 1.5A. The following are the relevant variables to determine the current limit:

$V_{in} = 6-24\text{ V}$
 $V_{out} = 5\text{ V}$
 $f_{sw} = 300\text{ kHz}$
 $L = 15\text{ }\mu\text{H}$

Over Current Limit

CURRENT_3A
 $R_{110} = 160\text{ k } 1\%$

CURRENT_1_5A
 $R_{111} = 390\text{ k } 1\%$

$V_{in} = 24 \rightarrow I_{limit} = 3.06\text{ A}$
 $V_{in} = 6 \rightarrow I_{limit} = 2.72\text{ A}$

$V_{in} = 24 \rightarrow I_{limit} = 1.48\text{ A}$
 $V_{in} = 6 \rightarrow I_{limit} = 1.14\text{ A}$

Following the reference design here ($f_{sw}=300\text{ kHz}$).

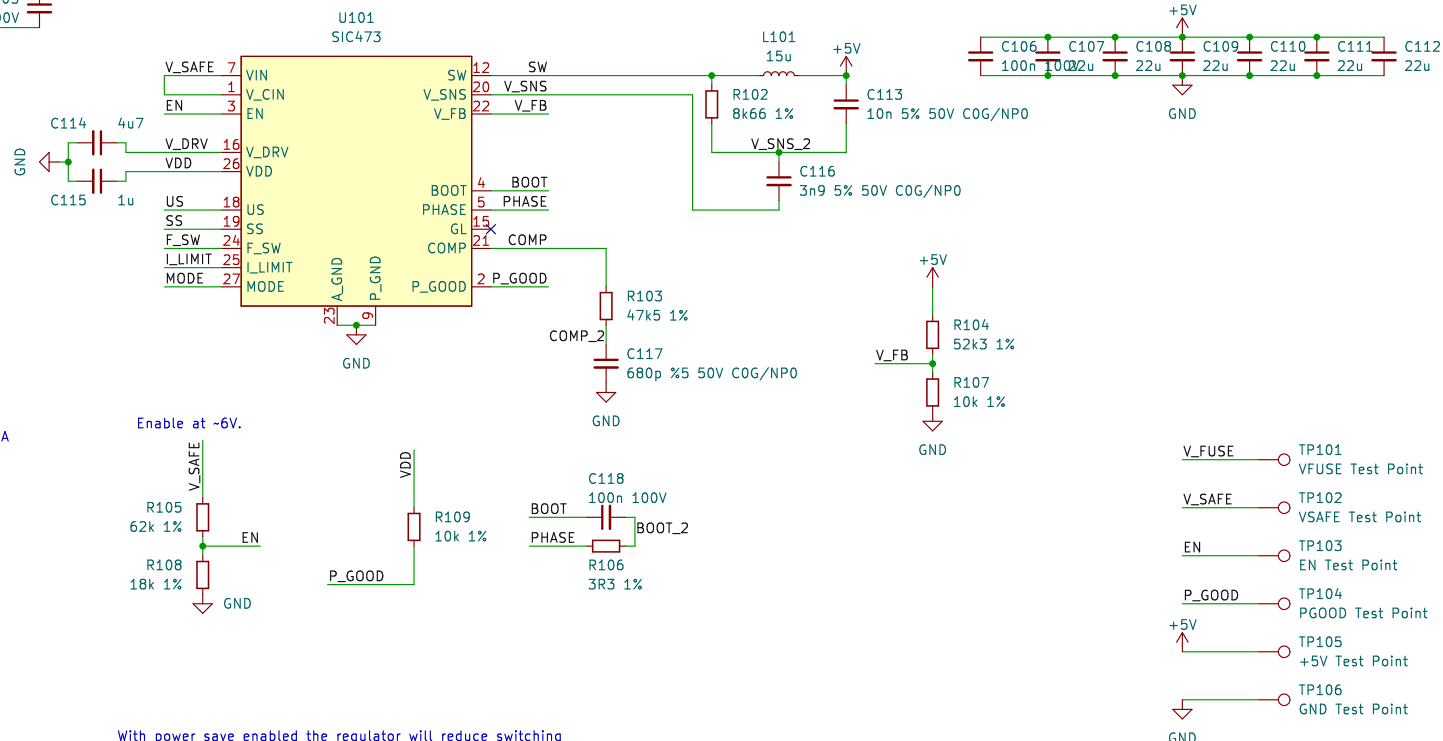
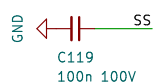


We want to use the soft start feature to keep inrush current low to avoid damaging the FFC connection between this board and the display board (worst case current limit is 1.5A when not using the hinge as a GND connection). We need to be particularly careful because the capacitance on the display board can be quite large (~4.7uF per LED, ~150 LEDs).

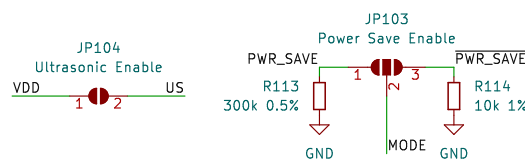
$$t_{ss} = C_{ss} * 0.8\text{ V} / 5\text{ uA}$$

$$I_{rush} = V_{out} * C_{out} / t_{ss}$$

As a starting point, I have picked a target I_{rush} of 300mA, a estimated worst case C_{out} of 1mF, and V_{out} is 5V. This gives a C_{ss} of approximately 100nF. 100nF this gives an I_{rush} of 312mA and a start up time of 16ms.



With power save enabled the regulator will reduce switching frequency as the load decreases, down to a few hundred Hz. If this is problematic for the microphone the ultrasonic mode limits the switching frequency to above 20kHz. With power save disabled the switching frequency will be fixed to 300kHz.



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