Adjustable Power Supply (1.2V–50V @ 3A)

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Course: Electronic Construction

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Introduction

This project involves designing and building adjustable DC-DC converter capable of delivering a regulated output voltage with a range between 1.2 [v] and 50 v and with a maximum current of 3 A. The circuit is based on the LM2576-ADJ switching regulator that ensures efficient power conversion and compact thermal management. The design includes screw terminals for convenient input/output connections and a power LED to indicate input supply. The compact, low-profile PCB design incorporates a dedicated thermal zone that functions as an integrated heatsink, improving heat dissipation without requiring additional external components. To avoid and ensure a clean power delivery, the circuit features an LC filter (C5, L2) which reduces output ripple voltage caused of the switching regulator by at least 10 times, significantly improving signal stability. Moreover, the converter includes a built in current limiting protection to ensure safety against output overload and reliable operation under fault conditions.

Methodology

- **Weeks 15–17:** Finalize the schematic design using ORCAD-PCB and perform circuit simulations. Design the PCB layout, incorporating thermal vias, appropriate component placement, and trace width calculations based on current requirements.
- **Week 18:** Focus on procurement. Order components from DigiKey and submit the PCB design for manufacturing
- **Weeks 19–20:** Begin assembly. Solder both SMD and THT components, then conduct initial functionality tests, such as checking the power LED and adjusting the output voltage.
- **Final Week:** Perform validation by measuring output stability, ripple, and overall efficiency. Document the results and compare them with the simulation outcomes. Presentation slides for in-class demonstration.

Component List

BOM								
NO	QNTY.	REF	DESC	MANUFACTURER	SUPPLIER	SUPPLIER PART NO	Price	Available
1	1	CN1	2 PIN SCREW TERMENAL 5.08MM PITCH	WIEDMULLER	DIGIKEY	281-2888-ND	8.28	In stock
2	1	CN2	2 PIN SCREW TERMENAL 5.08MM PITCH	WIEDMULLER	DIGIKEY	281-2888-ND	8.28	In stock
3	1	C1	1uF/100V SMD SIZE 1206	MURATA/YAGEO	DIGIKEY	1206B105K101CT	1,62	In stock
4	3	C2,C5,C8	100uF/63V SMD	NICHICON	DIGIKEY	493-6185-1-ND	3x7,58=23	In stock
5	2	C3	2200uF/63V THT	NICHICON	DIGIKEY	493-1360-ND	27.9	In stock
6	5	R1,J1,C4,C6,C7	DNP				Optional	
7	4	D1,D2,D3,D4	1N5408	ON SEMI	DIGIKEY	1N5408G	3,94	In stock
8	1	D5	RED LED SMD	OSRAM	DIGIKEY	HSMC-C170	4.95	In stock
9	1	D6	MBRS360	ON SEMI	DIGIKEY	MBRS360T3GOSCT-ND	3.34	In stock
10	1	L1	150uH/5A 30MM DIA	BOURNS	DIGIKEY	652-2200LL-151-H-RC	41.65	In stock
11	1	L2	20uH OR 12uH/4.5A 12MMX12MM	BOURNS	DIGIKEY	SRR1260-120MTR-ND	10.21	In stock
12	1	P1	50K POT 16MM	BOURNS	DIGIKEY	PDB181-K415K-503B-ND	13.14	In stock
13	1	R2	4.7K 5% SMD 2512 OR 1210	MURATA/YAGEO			1.21	In stock
14	1	R3	1.21K 1% SMD SIZE0805	MURATA/YAGEO			1.21	In stock
15	1	U1	LM2576HVT-ADJ TO220	TEXAS	DIGIKEY	LM2576HVT-ADJ/NOPB-ND	67.33	In stock

Figure 1: Component list with pricing.

Schematic

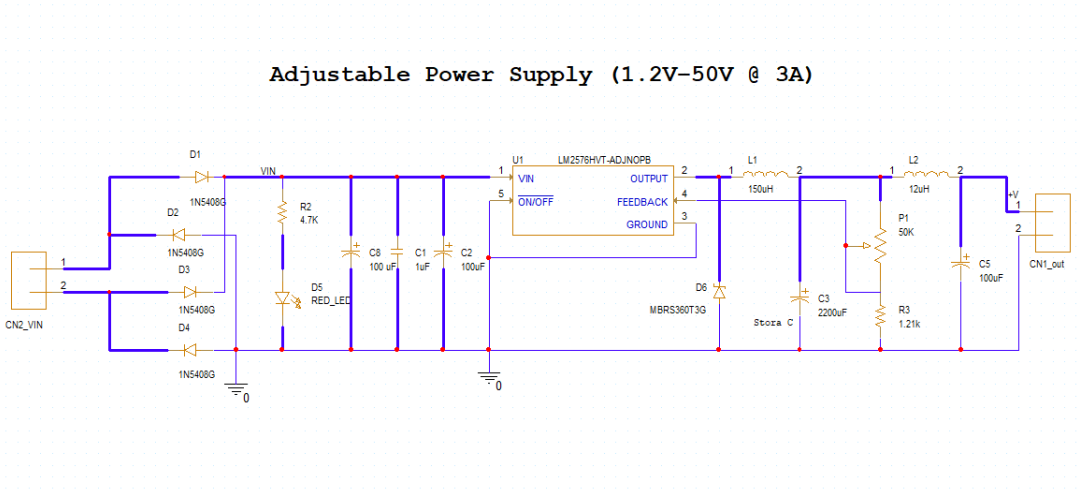

Figure 2: Schematic diagram.