Comprehensive Workshop Document – Buck Converter & PCB Design

Date: 06 January 2026

Task 1: Buck Converter Design

Specifications

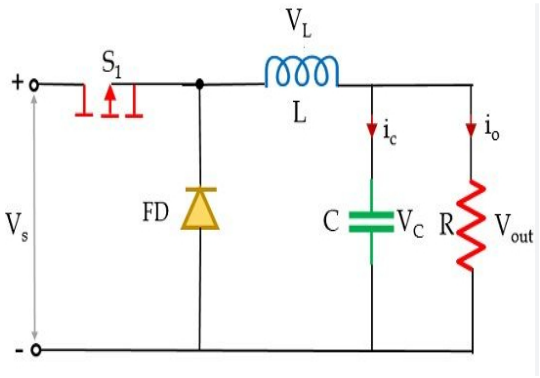
1. Vin: 40V–60V
2. Vo: 12V
3. Po: 60W
4. Switching Frequency: 340kHz
5. Soft Start Time: 3ms
6. Spread Spectrum: Not used

Design and Calculations Required

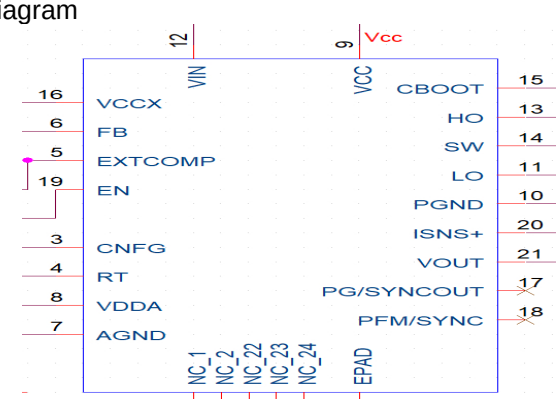
1. Main inductor
2. Power FETs
3. Switching frequency resistor
4. Inductor current sense
5. Input and output capacitors
6. Input and output filter
7. Control loop feedback
8. Vcc capacitors
9. Surge protection: TVS diode for 100V bidirectional
10. Additional components needed on the board

Mechanical & Layout Requirements

1. Material: FR4
2. Board Thickness: 1.6mm ±10%
3. General Tolerance: 0.2mm
4. Tolerance Between Holes: 0.1mm
5. All Holes: PTH unless otherwise specified
6. Barcode Area: 10x10mm anywhere on component side
7. No Components Allowed: All blue areas
8. Dimensions from DXF files
9. Geometric Tolerances per ASME Y14.5-2018
10. Quality Inspection per SolarEdge instructions (DOC-SP-00015 and DOC-SP-00110)
11. Compliance: RoHS Directive (EU) 2015/863, EU REACH EC1907/2006, TSCA (US EPA) restrictions
12. Layout deviations must be approved by mechanical designer
13. Contact SolarEdge Mechanical Department for clarifications if mismatch occurs



Buck Converter Circuit Diagram



LM5148RGYR Controller Pinout

Task 2: Current Sense Design

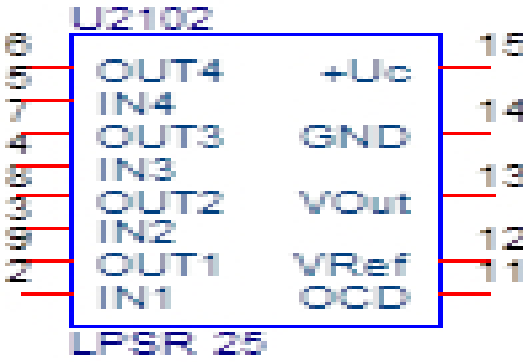
Specifications

1. Measure current from -75A to +75A
2. A/D input voltage: 0–2.5V
3. Add overcurrent protection as an I/O to DSP

Design and Calculations Required

1. Current sense input and output
2. Calculate gain and note it in the schematic
3. Design differential amplifier with additional 1.25V input

LEM Current Sensor (LPSR 25-NP)



LPSR Schematic Symbol

Grading Distribution

Criteria	Points
Schematic Quality	30%
Placement & Routing Readiness	25%
Calculations & XLS File	20%
Documentation & Explanations	15%
Compliance with Design Rules	10%

Additional Recommendations

1. Double-check component ratings for voltage and current margins
2. Validate thermal considerations for FETs and inductors
3. Ensure EMI mitigation (proper filtering and layout practices)
4. Add clear comments in the schematic for future reference
5. Use color coding or grouping for clarity in complex sections

Student Checklist

1. Complete and readable schematic
2. Verify all nets are connected (Pass netlist)
3. Prepare XLS file with calculations
4. Include DXF file from mechanical team
5. Confirm schematic with course guide
6. Design Buck converter according to specs
7. Add surge protection (TVS diode)
8. Implement DGND and PE ground spacing (240 mil)
9. Add ATP and TP test points
10. Annotate schematic and add notes
11. Prepare current sense design if Buck is complete
12. Ensure compliance with mechanical drawing (PCB thickness, tolerances)
13. Follow RoHS, REACH, TSCA compliance
14. Include all required components and filters