

Building Stage	Requirements	Testing Procedures	Debugging Technique
Rectifier Converter Output	The rectifier should provide a stable $108 \pm 2.16\text{V} / 3 \pm 0.6\text{A}$ DC output.	<ol style="list-style-type: none"> 1. Provide a stable 120 V AC power supply. 2. Provide rated load with HP Electronic Load 3. With a wattmeter to measure voltage and current across output. 4. Compare the measured values with requirements values. 	<ol style="list-style-type: none"> 1. Check: <ol style="list-style-type: none"> a. For correct components b. For correct circuit wiring c. Damaged chip with diode tester d. Correct conduction of single diode
Flyback PFC Controller	Output should be variable duty ratio square wave, nominally 50%.	<ol style="list-style-type: none"> 1. Wire designed circuit components 2. Provide V_{CC} power of 12V 3. Check output of the controlled with oscilloscope. The output should be a square wave with a nominal 50% ratio. 	<ol style="list-style-type: none"> 1. Check: <ol style="list-style-type: none"> a. For correct circuit wiring b. Supply power, ground, and enable 2. Vary resistor and capacitor set point values
Flyback Gate Driver	High current square wave with adjustable amplitude based on MOSFET source voltage	<ol style="list-style-type: none"> 1. Wire designed circuit components 2. Provide V_{CC} power of 12V 3. Provide low-current switching frequency from function generator 4. Check output with oscilloscope. 5. Confirm 	<ol style="list-style-type: none"> 1. Check: <ol style="list-style-type: none"> a. For correct circuit wiring b. Supply power and ground 2. Confirm that Cboot voltage is constant
Flyback Converter Output	The flyback should provide a stable $25 \pm 0.5\text{V} / 8.2 \pm 0.164\text{A}$ output voltage.	<ol style="list-style-type: none"> 1. Provide a stable 108V DC power supply. 2. Provide rated load HP Electronic Load 3. With a wattmeter to measure voltage and current across each output. 4. Observe voltage and current ripple with scope. 	<ol style="list-style-type: none"> 1. Check: <ol style="list-style-type: none"> a. MOSFET switching signal b. MOSFET signal ringing - snubber circuit c. MOSFET gate-source voltage d. For damaged parts e. For inductor saturation
Low Buck Converter Output	The low power buck should provide a $5 \pm 0.1\text{V} / 5 \pm 0.1\text{A}$ output.	<ol style="list-style-type: none"> 1. Provide a stable 25V DC power supply. 2. Provide rated HP Electronic Load 3. With a wattmeter to measure voltage and current across each output. 4. Observe voltage and current ripple with scope. 	<ol style="list-style-type: none"> 1. Check: <ol style="list-style-type: none"> a. duty ratio set resistors b. enable pin c. capacitor size d. output ripple

Building Stage	Expected Results	Testing Steps	Debugging Technique
High Buck Converter Output	The high power buck should provide a $12 \pm 0.24V / 15 \pm 0.3A$ output.	<ol style="list-style-type: none"> 1. Provide a stable 25V DC power supply. 2. Provide a HP Electronic Load 3. With a wattmeter to measure voltage and current across each output. 4. Observe voltage and current ripple with scope. 	<ol style="list-style-type: none"> 1. Check: <ol style="list-style-type: none"> a. duty ratio and frequency set pins b. MOSFET switching signal c. MOSFET gate-source voltage d. Inductor size
Load Regulation	The calculated load regulation value needs to be below 5% to be acceptable.	<ol style="list-style-type: none"> 1. Using an electronic load in constant current mode, the circuit will be tested under full load and no load conditions. 2. Calculated the load regulation can compare with requirements. 	<ol style="list-style-type: none"> 1. Load regulation will be calculated from the buck control chips.
Power Factor	The input voltage and current must be the same shape and have the same phase to attain a high power factor.	<ol style="list-style-type: none"> 1. Place the wattmeter across the input and measure the input voltage and current. 2. With a current probe and voltage probe display the input voltage and current on the oscilloscope. 	<ol style="list-style-type: none"> 1. The PFC IC will maintain a high power factor. Debug this chip if PF does not exceed 85%.
Harmonics	Major peak at 1, with dissipating peaks at the third fifth and seventh harmonic.	<ol style="list-style-type: none"> 1. A harmonic analysis will be conducted using an oscilloscope's math FFT function and THD calculations [15]. 	<ol style="list-style-type: none"> 1. Debug PFC chip.
Efficiency	The calculated efficiency value needs to be at least 85% to be expectable.	<ol style="list-style-type: none"> 1. Connect a wattmeter to the input to measure the input power. 2. Connect another wattmeter to the output of measure the output power. 3. Compare the input and output power to calculate the efficiency. 	<ol style="list-style-type: none"> 1. Reduce length of connections 2. Place circuit on PCB 3. Check solder joints