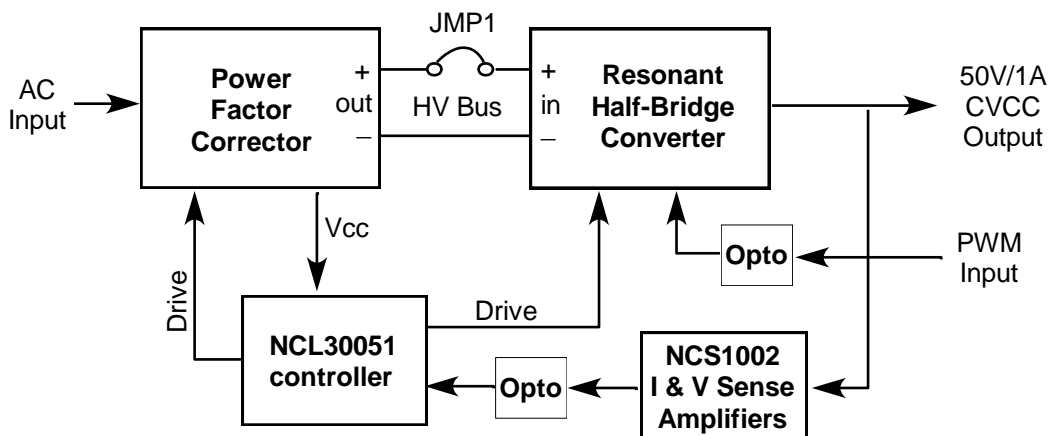




Test Procedure for the NCL30051LEDGEVB Evaluation Board

Introduction:

The NCL30051 constant voltage, constant current (CVCC) demo board is a high efficiency, 50 volt output, universal input, off-line power supply which incorporates a boost power factor corrector section followed by a resonant half-bridge step-down converter section. The NCL30051 controller contains the circuitry to control both the PFC and resonant half-bridge power sections. The 50 volt, 1 amp output is intended for LED lighting or similar applications. Current and voltage control is accomplished by secondary side sensing with the NCL1002 dual op-amp plus voltage reference and optocoupler feedback that controls the bulk output voltage of the PFC stage. The resonant half-bridge converter operates in a symmetrical, full duty ratio mode and is essentially a dc-to-dc step-down transformer. Refer to the NCL30051 product page at onsemi.com for further information on the part and the associated app note for complete circuit specifications and operation details. The basic block diagram for the circuit is shown below.



Test Procedure

Test Equipment Required:

1. Adjustable, isolated AC power source capable of providing zero to 265 Vac with up to a minimum of 2 amps output.



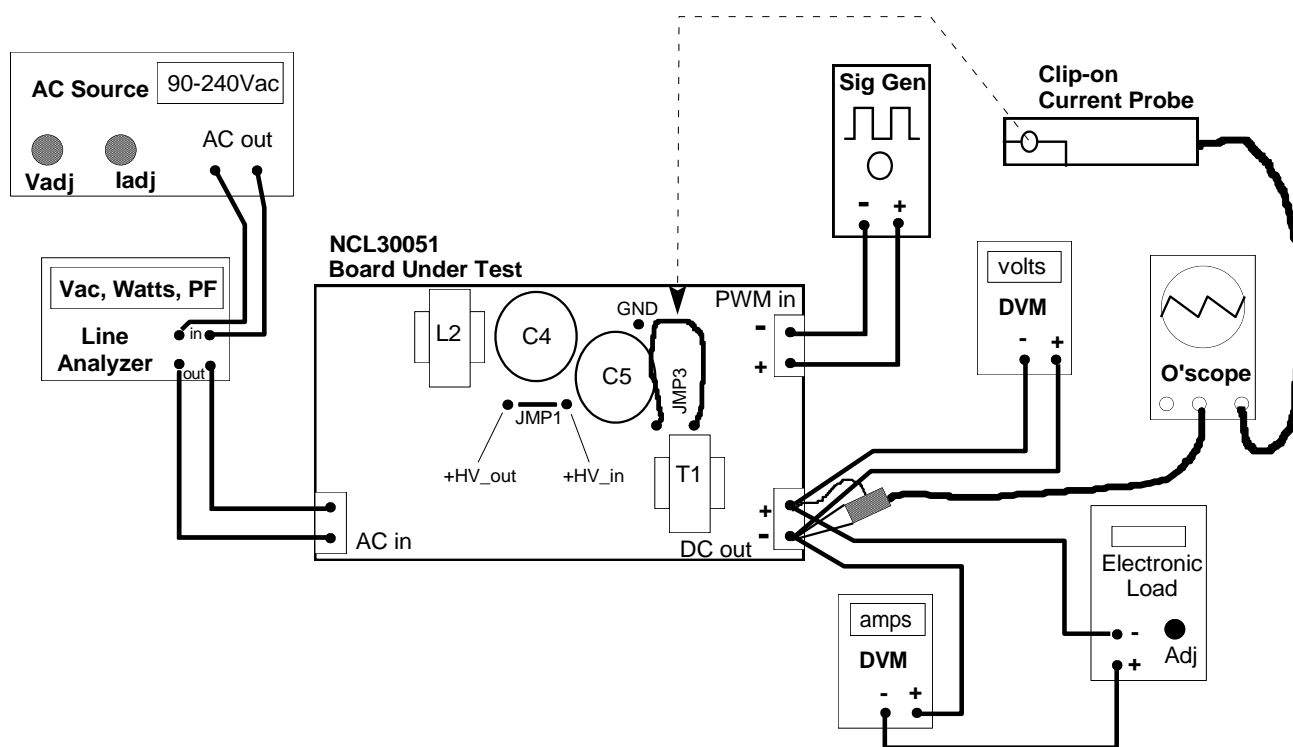
2. AC line analyzer such as Voltech PM1000 or similar. Analyzer should be able to measure input power in watts, RMS line voltage, and power factor (PF). If the AC power source is able to measure these parameters accurately and is calibrated, the analyzer can be omitted.
3. Digital volt/amp meters to measure output current and voltage to the electronic load (internal meters in electronic load are acceptable if calibration is correct).
4. An electronic load capable of up to 55V and 1 amp load. It will be necessary to have it operate in a resistive mode only up to at least 500 ohms. This type of load may be problematic when testing in the PWM dimming function. Electronic loads are not well suited for testing this mode because a load with a constant voltage drop is required. If available a true LED load with a V_f of 35 to 48 volts rated at 1A or more. An alternative is a stack of series zener diodes that will simulate the LED load and V_f yet will handle 1 amp of current.
5. Oscilloscope with probe to monitor output ripple on the demo converter.
6. A clip-on current probe to monitor the resonant half-bridge inverter current.
7. An audio or similar signal generator to provide an 800 Hz output at a 50% duty cycle to check the PWM dimming function.
8. A 10K, 50 watt resistor with appropriate clip leads (Q-ball type best) for preliminary loading of the power factor corrector circuit.
9. A 1K, 5W resistor with appropriate clip leads (Q-ball type best) for current limited testing of the half-bridge converter once the PFC has been tested.

Setup Procedure:

It is highly recommended that the assembled NCL30051 demo board be thoroughly inspected for proper component assembly, solder integrity, component values per the BOM, etc. As a minimum, all rectifier and electrolytic capacitor orientations (polarity) should be checked to avoid catastrophic failure during initial tests.

Set the equipment up as shown in the diagram below at the designated step in the test procedure so that the output voltage and current to the demo board can be measured and the AC input parameters can be monitored with the line analyzer. The oscilloscope should be set up so that either the output ripple or the half-bridge inverter current (via clip-on probe) can be monitored.

NOTE: The current probe tests (7 thru 11) should be performed on just a couple of boards per batch. If the boards tested prove to be as per the parameters of this test procedure, then we can assume that all boards in this batch only are ok for these particular tests. It is crucial that all other tests are performed for all boards and that they are observed to be operating within spec before one can assume board integrity.

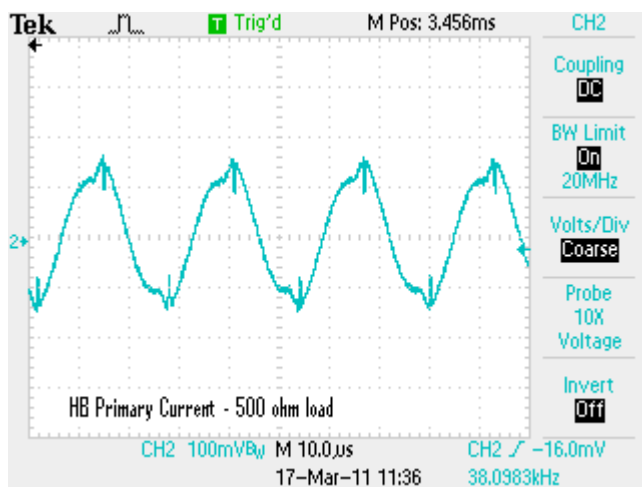


Test Procedure:

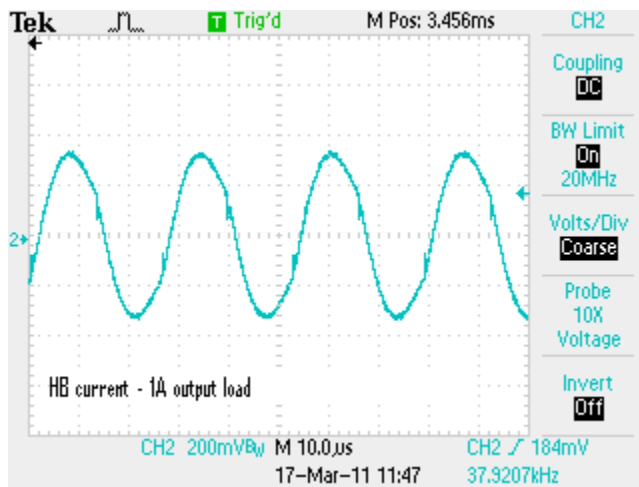
1. Connect the AC source to the demo board under test as shown in the diagram above. With the AC source OFF, set the current limit on the AC source to 2 amps and the output voltage to 115 Vac.
2. Make sure JMP 1 is not installed on the board under test. Connect the 10K, 50 watt minimum rated power resistor via clip leads from the +HV_out test point to the GND test point (this is a load for PFC). No other instrument connections should be made to the demo board at this time.
3. Connect a DVM to these test points or directly to the 10K load resistor to measure the output voltage when the AC source is switched on. CAUTION: A high voltage exceeding 500 Vdc will be placed across this resistor when the AC source is turned on. The resistor will also get very hot!
4. Turn on the AC source and the power supply demo board should exhibit a stable output voltage on the DVM of between 480 and 510 Vdc.
5. Increase the AC source voltage to 230 Vdc and the DVM reading for the PFC bulk voltage should remain approximately 495 Vdc. Reduce the AC input back to 115 Vac and check that Vout is still within the proper range and switch the AC source off.
6. Disconnect the 10K, 50 watt load resistor from the test points, and then connect the 1K, 5 watt resistor from the +HV_out test point to the +HV_in test point with clip leads.



7. Connect the electronic load and a DVM to the demo board DC output terminals as shown above. Set the load in the resistive mode to 500 ohms. Also connect the clip-on current probe around the 3 inch current sense jumper wire (JMP3) next to the transformer T1 on the board and attach the probe cable to the O'scope. It is not necessary to connect the scope's voltage probe or the signal generator to the demo board yet.
8. Switch on the AC source (115 Vac) and the demo boards's output voltage should read approximately 50 volts on the DVM (or electronic load). The O'scope should show a current waveform from the current probe that looks like the screen capture below.



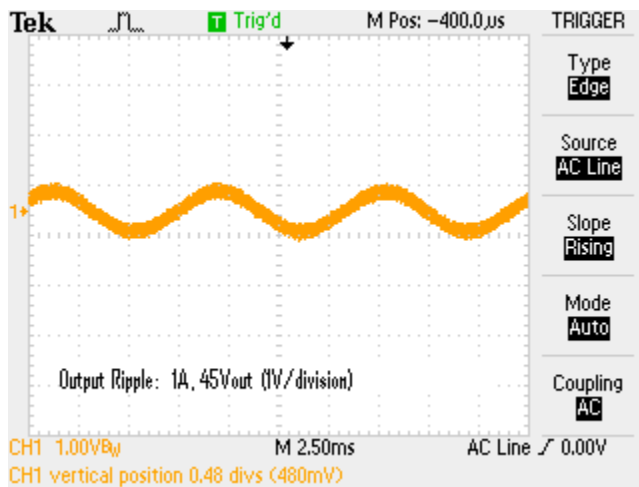
9. Switch the AC source off, disconnect the 1K resistor from +HV_out to +HV_in and directly connect these two test points with a clip lead. Set the electronic load connected to the demo board output to 45 ohms (approximately).
10. Switch the AC source back on at 115 Vac and the demo board output on the DVM should show about 45 volts and the output current to the electronic load should be between 0.90 and 1.10 amps (1 amp nominal). The half-bridge inverter current waveform on the O'scope should appear as shown below (note the scale has been changed to 200mV/division).



11. Switch the AC source off, remove the clip lead and current probe and all other connections from the demo board. Solder wire jumper JMP1 permanently to the board and replace the current sense loop (JMP3) with a similar, short jumper wire. #24 or #26 AWG tinned bus wire should be used.

The board is now deemed to be functional. The following tests check the basic performance of the board.

12. Re-connect the board as shown as above but without the current probe or signal generator connected.
13. Switch the AC source on at 115 Vac and decrease the load resistance until the output reads 25 Vdc. The output current should still be 1.0A +/- 100mA. Lower the AC input to 90 Vac and Vout and Iout should remain constant. The power factor (PF) should be > 0.90.
14. With AC in at 90 Vac increase the load resistance until Vout is 50Vdc. The output current should still be 1A +/- 100mA and the PF should be > 0.90.
15. Increase the AC input to 230Vac. Vout and Iout should remain constant and the PF should be > 0.90.
16. Decrease the load resistance until Vout reads 35 Vdc. Iout should still be 1 amp and the PF should be > 0.90. The supply should be stable at this Vout.
17. Increase the output load resistance until Vout is 45 Vdc. Calculate the efficiency by dividing the output power (Vout x Iout) by the input power. Efficiency should be > 87%.
18. Lower the AC input to 115 Vac and repeat the efficiency test with Vout = 45 Vdc. Efficiency should be > 87%.
19. Increase Vout until the current starts dropping below 1A. This should occur between 50 and 55 Vdc (or Vout max).
20. Re-set the load to about 45 ohms such that Vout is 45 Vdc. The output voltage ripple on the O'scope should appear as below and be approximately 1 volt p/p



21. If a simulated LED load (stack of zener diodes) or actual LED load with a V_f of between 40 and 50 volts is available, connect this to the demo board output with a series DVM to measure output current, and connect the signal generator to the PWM input connector. The generator should be set for a 210 Hz square wave output with a 50% duty cycle and a peak output voltage between 5 and 10 volts.
22. Switch on the AC source at 115 Vac and note the output current from the demo board. It should be 500 mA \pm 50 mA due to the PWMing of the output.
NOTE: This test cannot accurately be performed on a resistive or electronic load. The load MUST simulate the LED string's V_f constant voltage characteristic.
23. Switch the signal generator off (or carefully disconnect) and the output current should return to 1 amp.
24. Switch AC off and disconnect the demo board.

END of TESTS