

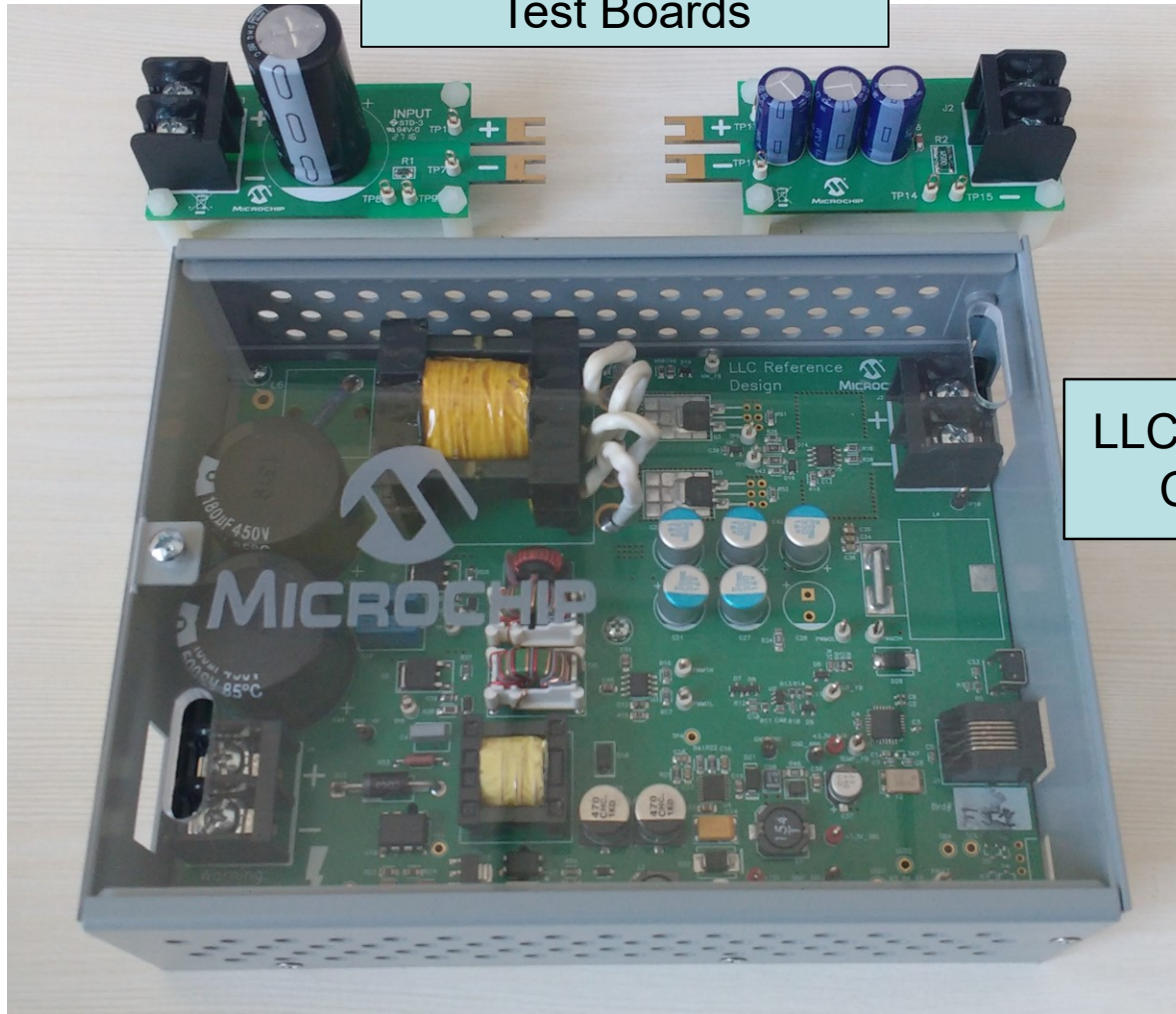
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LLC Resonant Converter Reference Design – EP *Demo Instructions*

What's Included?

Input/Output Efficiency
Test Boards



LLC Resonance
Converter

Setup and Connections

- **Visually inspect the system to ensure no damage has been caused to the unit during shipping.**

Setup and Connections

- Connect the input cables to the input of the LLC converter and to a DC source (input 350Vdc to 420Vdc)
- Connect the output cables to the output of the LLC converter and to a DC load
- **Note:** The efficiency boards are provided to help in calculating the efficiency of the converter. They can be connected at all times but are not necessary.

System Power Up

- Upon power up the LLC Resonant Converter waits in an idle state for ~3sec before beginning the soft-start. This is to provide enough time for a DC source to ramp up. This time is configurable in software.

System Power Up

- As per the design of the auxiliary circuit, the auxiliary fly-back circuit needs time to discharge in between input voltage power cycles. The converter may not re-start if the power is cycled too fast.

System Operation

- When the system is powered and running LED D3 is powered on.
- If the system enters into fault mode LED D1 blinks indicating which fault had occurred.

Soft-Start

- With the system powered off connect an oscilloscope probe to the output terminal (TP9 and TP10).
- Setup the oscilloscope for a single capture on the rising edge (5-10ms per division).
- Power on the system and observe the soft-start.
- Re-run the test with load and observe the soft-start.

Frequency Modulation

- With the system powered off connect oscilloscope probes to PWM1H and PWM2H test points on the LLC converter (or PWM1L and PWM2L).
- Power on the system
- Change the input voltage and observe the change in frequency.
- When operating below resonance observe the duty cycle of PWM2 with respect to PWM1
- Add load and observe the frequency

Load Step Changes

- With the system powered off connect a DC load to the output terminal (J3), connect a current probe on the load cable, and connect an oscilloscope probe to the output test points (TP8 & TP9).
 - Power on the system
 - Typical load steps to be performed (4A – 12A), (12A – 4A).
 - Observe the response of the output voltage on the oscilloscope.
 - Measure settling time and under/over shoot.
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Measuring Efficiency

- With the system powered off connect both efficiency boards
 - Verify that the boards are connected correctly
- Connect the input/output cables
- Connect multi-meters:
 - Input terminals TP1 & TP7 (Input Efficiency Board)
 - Across input shunt resistor TP8 and TP9 (Input Efficiency Board)
 - Output Terminal on LLC board TP9 & TP10
 - Across output shunt resistor TP14 and TP15 (Output Efficiency Board)
- Connect load
- Power on the system
- Measure efficiency at different loads and input voltages

Efficiency Equation:

$$\frac{P_{out}}{P_{in}} = \frac{V_{out} * (V_{shuntR2}/0.005)}{V_{in} * (V_{shuntR1}/0.005)}$$