

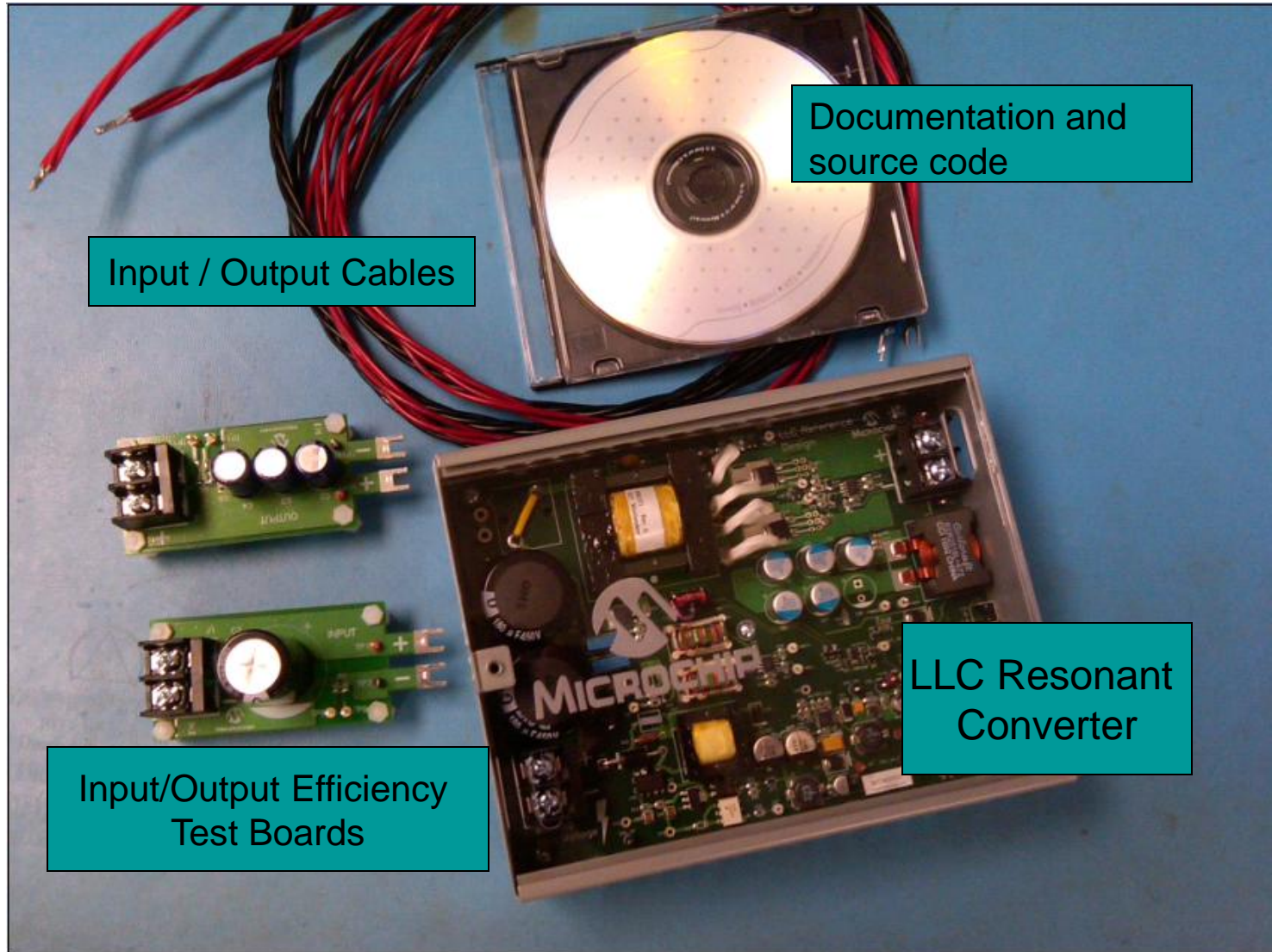


MICROCHIP

LLC Resonant Converter Reference Design

Demo Instructions

What's Included?





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. No need to power down the unit, just press the reset push button



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.



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:

$$P_{\text{out}} / P_{\text{in}} = (V_{\text{out}} * (V_{\text{shuntR2}} / .005)) / ((V_{\text{in}} * (V_{\text{shuntR1}} / .05))$$