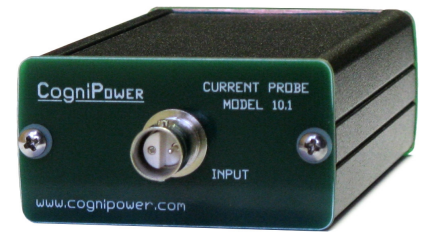




**CogniPOWER**  
power smarter



## The CogniPower Current Probe

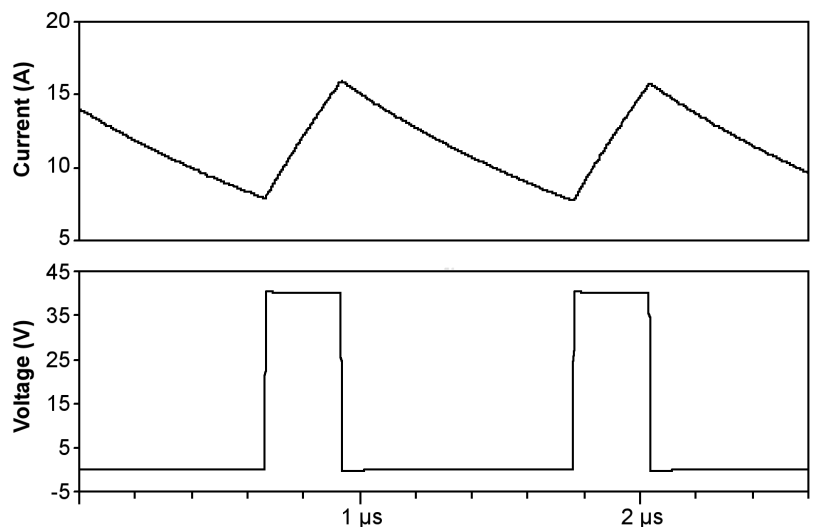
The CogniPower Current Probe Model 10 is a fast and accurate instrument for measuring AC and DC current in high-speed circuits. Insertion losses are so small that no derating is needed. The CP Model 10 is fast enough to detect transients that can lead to destructive behavior in switched mode power converters (SMPCs). The probe exhibits outstanding common mode rejection, dynamic range, and bandwidth. It is powered by a rechargeable battery and will work with any make of oscilloscope.

It is challenging to measure instantaneous AC and DC current in a switched inductor, particularly in an H-bridge where both ends of the inductor are swinging rapidly between very different voltages. Clamp-on probes cannot handle high currents at high frequencies and will disrupt the circuit under test because of insertion losses. Current measurements using conventional differential amplifiers have common mode rejection limitations under these conditions. A patent-pending means of operation enables the CP-10 probe to reveal the actual AC and DC currents, even in these difficult circumstances, with exceptional speed, accuracy and affordability.

### Accurate AC and DC Measurement

In the case of an inductor in continuous conduction with the Model 10, connected as shown in the test circuit diagram on the other side of the page, the 1 milliohm sense resistor is deliberately placed on the difficult side of the inductor to demonstrate the Model 10's common mode rejection.

On the right, the inductor current is seen ramping between 7 and 16 amps, in response to the totem pole switch. The low latency and high bandwidth of the CP-10 can reveal a potential converter problem before it is too late to prevent a damaging failure.

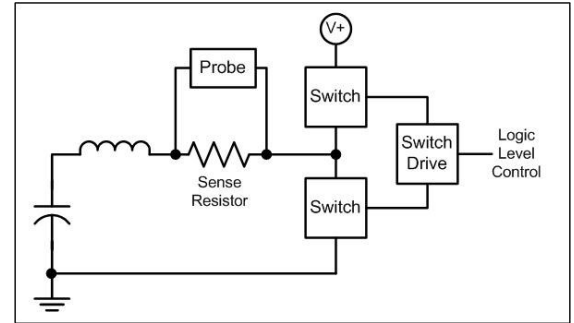


The waveforms show the CP-10's excellent rejection of drastic common mode voltage swings. What you cannot see in the current trace (upper trace) is that the insertion losses are negligible.

The voltage trace (lower trace) shows the speed and lack of overshoot and undershoot of our totem pool switch. What you cannot tell from the waveform is that there is no additional high-side supply needed for driving our high-side switch. It is built into the switch driver.

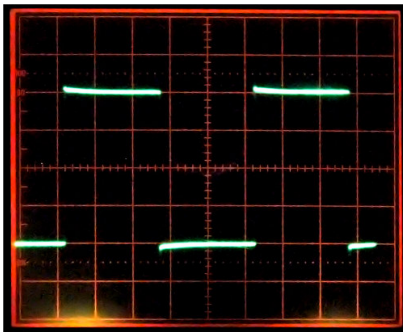
## A Totem Pole Switch Aids Demonstration

The totem pole switch we prefer to use to show the capabilities of the CP-10 is our proprietary, high-speed totem pole switch driven by our patent-pending isolated switch drivers. The switch has under 10 ns rise and fall times. Even without snubbing, overshoot and undershoot are minimal. Faster switching enables greater efficiency and smaller size. The absence of spikes means lower voltage switches can be used, which further reduces size and increases speed and efficiency. Power-robbing snubbers are entirely eliminated. Heat sinking requirements are minimized.



Test Circuit

Our switch drivers consume only marginally more than the minimum theoretical power required to drive a given gate capacitance at a given frequency. Screen shots of a 1 kW totem pole demonstration board in operation are seen below.



Totem pole output swinging between 0 and 40 volts at 200 kHz without snubbing



Transition time is 7 ns and overshoot is less than 2% (20 ns/div)



Transition time is 9 ns and undershoot is minimal

## The Future

Future versions of the current probe can be higher voltage or higher speed. The CP-10 circuitry can be made small enough and inexpensive enough to be built into capable SMPCs. The circuitry is sensitive enough to need less than an inch of bus bar as a sense element. Contact us for more information about integrating our current monitor into a switched power device.

The advantages of our current monitoring and our superior switches, in combination, will allow the construction of greatly improved SMPCs. We look forward to a new generation of more capable, more agile, more reliable power converters.

## CP Current Probe Model 10 Specifications

- Bandwidth: DC to 10 MHz +/- 50 amps; larger currents can be measured with smaller sense resistors
- Common mode range: 0-50 volts with over-range tolerance and over-voltage and over-current protection
- Insertion loss: with standard sense resistor, 1 milliohm, resistive
- DC Common mode rejection: 96 dB
- No degaussing
- Battery life: 4 hours minimum      Charging time: 2 hours typical (charger included)
- Introductory Price: \$995, production quantities available in the second quarter of 2009

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