Test Methods

GENERAL TEST-SET-UP

Figure 1 Show a general DC/DC converter test set-up. Except where otherwise required, the following conditions apply:

- The input voltage is nominal DC input voltage.
- The load is set to the rated output load (full load).
- The ambient temperature is 25℃.

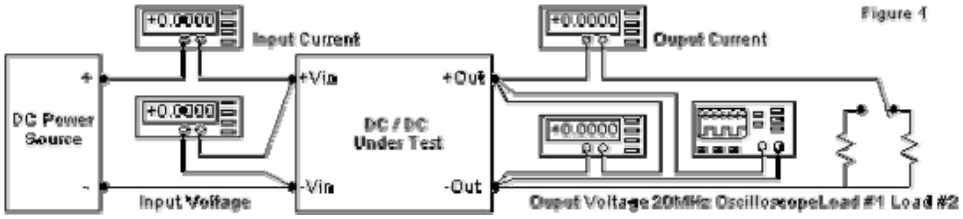

Figure 1

MEASUREMENT

All connections to the converter should be made with great care, especially to the output pins. Standard four-terminal or Kelvin, measurement practices should always be observed in making DC/DC converter measurements. Figure 2 shows a voltage measurement being made from the output terminals of a DC/DC converter by means of separate contacts which do not carry load current. If contacts carrying load current are used for measurement, an erroneous reading of many mill volts can result

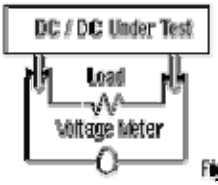

Figure 2

OUTPUT VOLTAGE ACCURACY

Make and record the following measurements:

1. Output voltage at nominal input voltage (VON).
2. Calculate output voltage accuracy from the following formula.

$$\text{Output Voltage Accuracy} = \frac{V_O - V_{ON}}{V_{ON}} \times 100\%$$

VO is output voltage specified in data

LINE REGULATION

Make and record the following measurements:

1. Output voltage at nominal input voltage (VON).
2. Output voltage at maximum input voltage (VOH).
3. Output voltage at minimum input voltage (VOL).

$$\text{Line Regulation} = \frac{V_{ON} - V_D}{V_{ON}} \times 100\%$$

VD is maximum output voltage deviation measured.

4. Calculate line regulation from the following formula.

LOAD REGULATION

Make and record the following measurements:

1. Output voltage with full load (VOF).
2. Output voltage with minimum load specified in data sheet (VOM).
3. Calculate load regulation from the following formula.

$$\text{Load Regulation} = \frac{V_{OF}-V_{OM}}{V_F} \times 100\%$$

EFFICIENCY

Make and record the following measurements:

1. Output voltage at nominal input voltage (VON).
2. Input current at nominal input voltage (IIN).
3. Calculate efficiency from the following formula.

$$\text{Efficiency} = \frac{V_{ON} \times I_O}{V_{IN} \times I_{IN}} \times 100\%$$

VIN is nominal input voltage and IO is output current.

OUTPUT RIPPLE AND NOISE

This is an AC measurement at the output of a power converter at rated load and 25ºC ambient temperature. The measurement is made in either mill volts RMS or mill volts peak-to-peak. Figure 3 shows the typical voltage waveform. In the case of DC/DC converters, the output ripple voltage is a series of small pulses with high frequency content, and for this reason is almost always specified as peak-to-peak rather than RMS value. A 50 mill volt peak-to-peak output ripple from a DC/DC converter can have a very low RMS value - perhaps just 5V- but this type of specification would be of questionable value to the designer who must specify the power supply for his system.

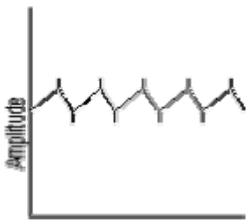

Figure 3

Because of the high frequency content of this ripple, special measurement techniques must be employed so that correct measurements are obtained. First, a 20MHz bandwidth oscilloscope is normally used for the measurement so that all significant harmonics of the ripple spikes are included.

The actual ripple voltage measurement must be carefully made in order not to induce error voltages in the test equipment. Therefore, the conventional ground clip on an oscilloscope probe (Figure 4) should never be used in this type of measurement. This clip, when placed in a field of radiated high frequency energy, acts as an antenna or inductive pickup loop, creating an extraneous voltage which is not part of the output noise of the converter.

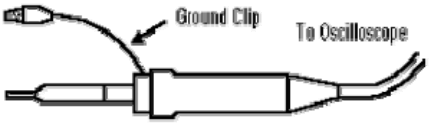

Figure 4

This noise pickup is eliminated as shown in Figure 5 by using a scope probe with an external ground band or ring and pressing this band directly against the output common terminal of the power converter while the tip contacts the voltage output terminal. This makes the shortest possible connection across the output terminals.

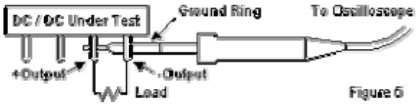

Figure 5

Another method of measuring the output voltage ripple & noise which is specified for many switching power supplies is shown in Figure 6.

A 30cm twisted pair of no. 20 AWG copper wire is connected to a 10uF capacitor of proper polarity and voltage rating. The oscilloscope probe ground lead should connect right to the ground ring of the probe and be as short as possible. The oscilloscope bandwidth should be 20 MHz and the oscilloscope should be connected to AC ground.

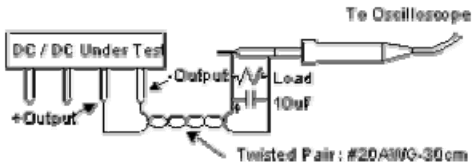

Figure 6