Using Parameter Trend Plots

Power Supply Regulation Measurements Using Trend Plots

Trend plots, which are available in LeCroy oscilloscopes, graphically display up to 20,000 individual parameter measurements on each trace. Any, of over 100 available parameters, can be used as a source of the trend plot. When two trends are cross-plotted on an X-Y display the functional relationships between the two parameters can easily be examined. As an example consider figure 1 which shows the pulse width of a switching power supply regulator as a function of the rms line voltage input. This plot includes data for three different values of output load current. Each of these trends (Trms [A] or Twidth[D]) contains 200 measured values. Trend plots are setup by defining one of the zoom/math traces using the ZOOM+MATH menu as shown in figure 1

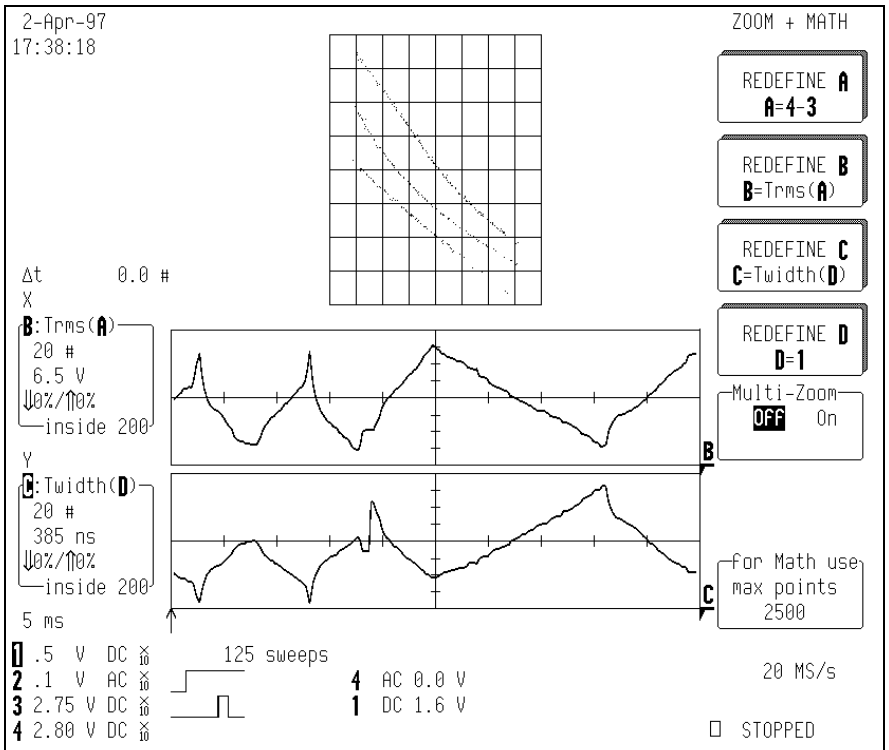

Figure 1 A cross-plot of power supply regulator pulse width as a function of rms line voltage with output load current as a parameter. Infinite display persistence retains all 3 cross-plots.

It is easy to see from figure 1 that the regulator pulse width (vertical axis) and input voltage (horizontal axis) are related to each other and that increasing line voltage results in decreasing pulse width. As the output load current was increased the plotted data moved upward indicating that the pulse width increases with increasing load.

This type of analysis also depends on several other features in the oscilloscope. First, the two parameters are measured over vastly different timing intervals. We use LeCroy's Smart Trigger to keep the measurements synchronous. A qualified trigger is used so that the oscilloscope is triggered on the first regulator output pulse after a line voltage zero crossing. This guarantees that the pulse width and rms voltage measurements are correlated in time.

Similarly, because of the difference in timing intervals this measurement requires the use of very long memories. Note that we are sampling the data at 20 Mega Samples/s for a total time of 50 ms. This means that the oscilloscope is acquiring over 1, 000,000 samples (50 ms * 20 MS/s = 1 MS). If this memory were not available then the sampling rate would have to be decreased and timing resolution would suffer.

The basic setup for this measurement is shown in figure 2. The input voltage to the supply is measured differentially. We subtract the neutral side (channel 3) of the line from high side (channel 4). We also use a zoom display to look at a single regulator output pulse . The trend data is accumulated on the rms value of the line voltage and the width of the regulator pulse width.

Figure 3 shows another example of a cross-plot of trend data. Here, the pulse width of the regulator is plotted as a function of the output load current. This cross-plot shows evidence of the non-linear characteristics of the power supply transformer.

Trend plots eliminate the need to make and record a large number of individual measurements. The oscilloscope makes the measurements automatically and plots the values in the order the values are taken. Multiple trends, acquired simultaneously, can be cross-plotted as shown in the examples. Once set up, the trend plots are generated automatically as the data is acquired.

Trending is just one of the tools available in LeCroy oscilloscopes optional waveform processing packages. Parameters can also be analyzed statistically using the histogram function. These analysis tools are supported by 18 additional statistical parameters for a complete statistical analysis solution.

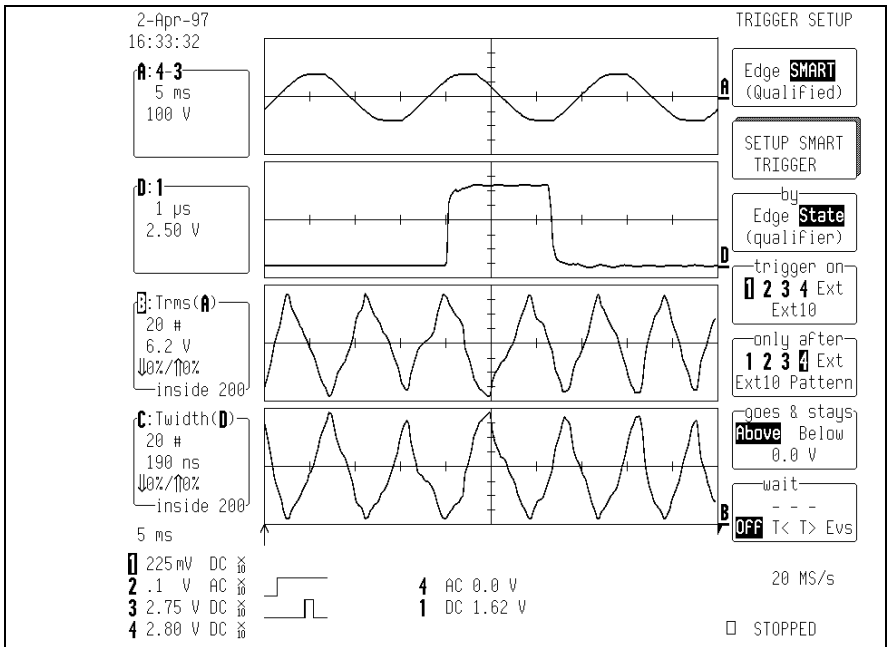

Figure 2 The trigger setup for the measurement

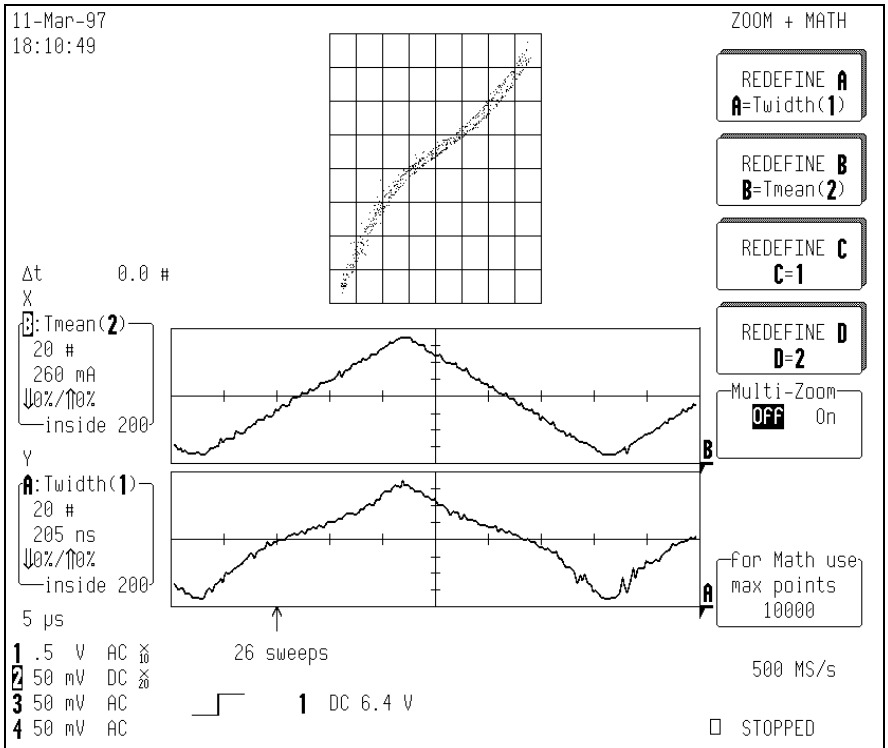

Figure 3 Cross-plot of trends of regulator pulse width (Y axis) and mean output load current (X-axis) showing the relationship between these two measured parameters