Curve Tracer Manual

Curve tracers are versatile instruments that characterize a wide variety of electronic components. Commercial curve tracers cost upwards of $30,000. We will use a homemade, computer-based curve tracer that has a few advantages over commercial units.[1] The curve tracer consists of a circuit that provides appropriate biases to the device leads and measures the currents into the leads, an analog to digital computer interface card, and a LabVIEW virtual instrument program that controls the biasing hardware and collects the resulting data. LabVIEW is an unsual programming environment that is superb for computerized data acquisition tasks.

Note that help for many of the controls can be obtained by typing ^H.

 If the Curve Tracer is not already running, start it by double clicking on the Curve Tracer icon. The main selection window will appear, from which you pick the device type to be analyzed.
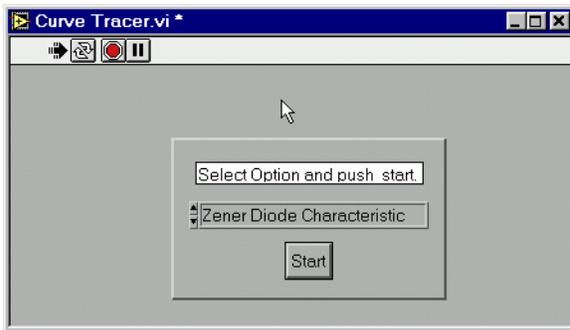
If the main selection window is visible, but not running, it will look like this:
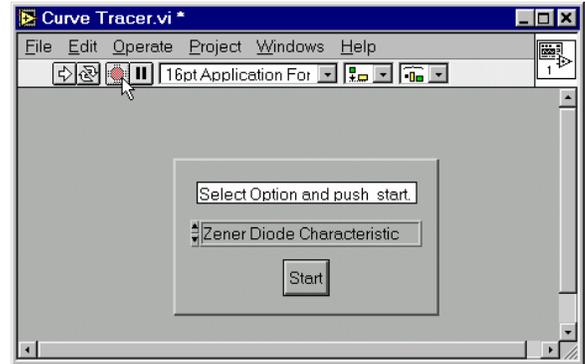
Restart it by pushing the go arrow: Once the main selection window is running, several different options can be selecting. Pick one, and hit the **START** button.

Diode Tracer

Selecting the Diode Tracer will cause this window to pop up:
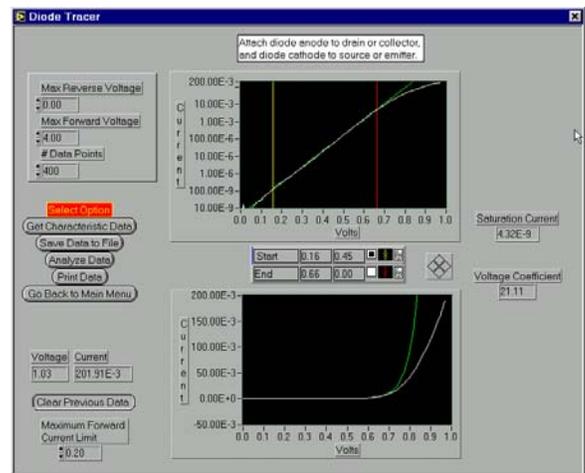
Attach your diode to the input connections, as described in the blinking box at the top of the screen, and press the **Get Characteristic Data** button. The diode characteristic will be plotted twice: on log/lin axis in the upper plot and lin/lin axis in the lower plot. The Curve Tracer will acquire and plot the diode characteristic. The reverse saturation current and voltage coefficient can be obtained by pressing

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[1] Our Curve Tracer is simpler to use and more accurate at lower currents than most commercial units, and can also calculate parameters like the gate source cutoff voltage automatically.

the **Analyze Data** button. The data can also be saved to a file and printed by pressing the appropriate buttons.

Toggling the **Clear Previous Data** button to **Keep Previous Data** will overlay additional characteristic traces over the initial trace. This option can be used to compare the curves for different devices.

Zener Diode Tracer

The Zener Diode Tracer scans from the
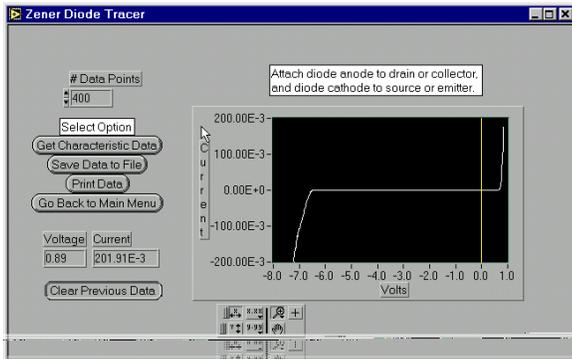
voltage zener voltage to approximately 0.5V. The controls are similar to those used by the Diode Tracer, but no analysis options are available.

JFET Transfer Tracer

The JFET Transfer Tracer determines a JFET's transfer characteristic by locating the
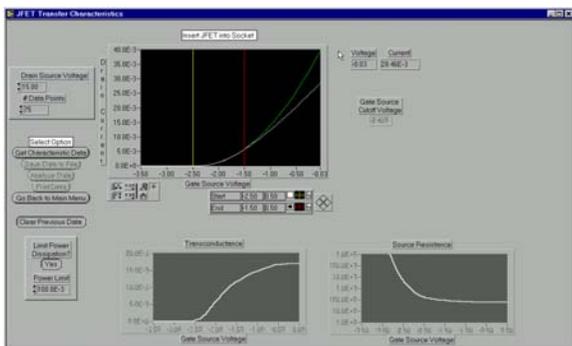
Gate Source Cutoff Voltage V_{GS}, and scaning the gate voltage from V_{GS} to ground, while keeping the drain source voltage fixed at the value set by the **Drain Source Voltage** control. The **Analyze Data** option will find the best fit parabola to the data and will also determine the transconductance and the source

resistance. The power limiting options allow the average power to be limited to the specified values. The remaining controls are similar to those used by the Diode Tracer.

Most JFET leads are too short to be directly connected to the Tracer banana inputs. The transistor input block provides a convenient way to insert the JFETs. The bottom of the block has three banana plugs which plug into the Tracer, and the top has two different size sockets.
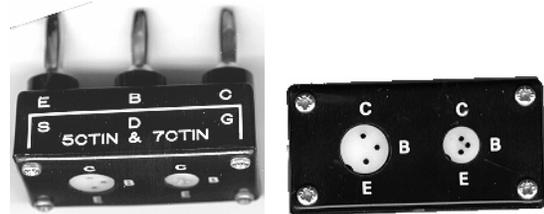
Use either socket, inserting the JFET source into the E (emitter) input, the gate into the B (base) input, and the drain into the C (collector) input.

The JFETs may dissipate a significant amount of power on certain scans, and heat up enough to change the characteristic curves. Use a heat sink to limit the JFETs' temperature rise. The fins on the heat sink increase the surface area in contact with the air, increasing the thermal conductivity between the JFET and the air, thereby increasing the cooling. Mount the heat sink onto the JFET by pushing the case of the JFET into the hole in the center of the heat sink.
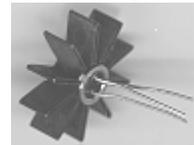
JFET Output Tracer

The JFET Output Tracer scans the drain
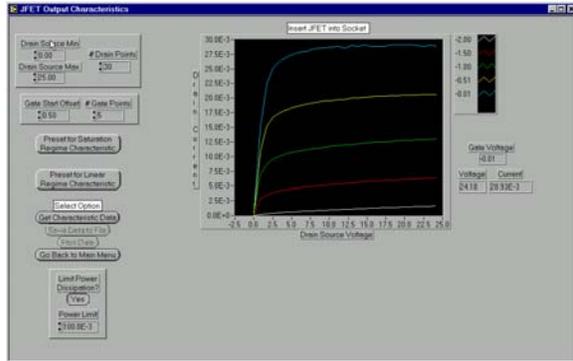
voltage, while measuring the drain current, for a series of fixed gate voltages. The lowest gate voltage equals V_{GS} plus the **Gate Start Offset**. The Tracer can be configured for linear and saturated scans with the preset buttons. The remaining controls are similar to the JFET Transfer Tracer controls, but there is no analysis function.

Curve Tracer Operation

The Curve Tracer contains two independent channels to drive the gate and the drain. The gate channel range is ±10V and can drive up to ±20mA. The drain channel voltage range is ±30V and can drive up to ±200mA. The output voltage and current is measured on each channel, and the current sensitivity is set by relay-selected resistors. The Tracer is controlled by a National Instruments Lab PC+ interface card, on which the two DACs are used to control the two output channel voltages, and four of the ADC channels are used to measure the currents and voltages. Two digital control bits are used to turn the voltages on and off, and two more select the current sensing resistors by driving the relays. The Lab PC+ board is controlled by a LabView virtual instrument.