

PC Printer Port Controls I-V Curve Tracer

This article describes an I-V curve tracer circuit that uses a computer for display and control. The circuit is controlled via the PC parallel port. Software is provided, written in BASIC, to control the measurement and display the results on the monitor.

When connected to the printer port of a PC, the circuit shown in Figure 1 enables you to determine the current-voltage (I-V) characteristics of an active component or integrated circuit. A short BASIC program* drives the port and displays the I-V characteristic as a graph on the monitor. The result is a very useful diagnostic tool for IC fault analysis.

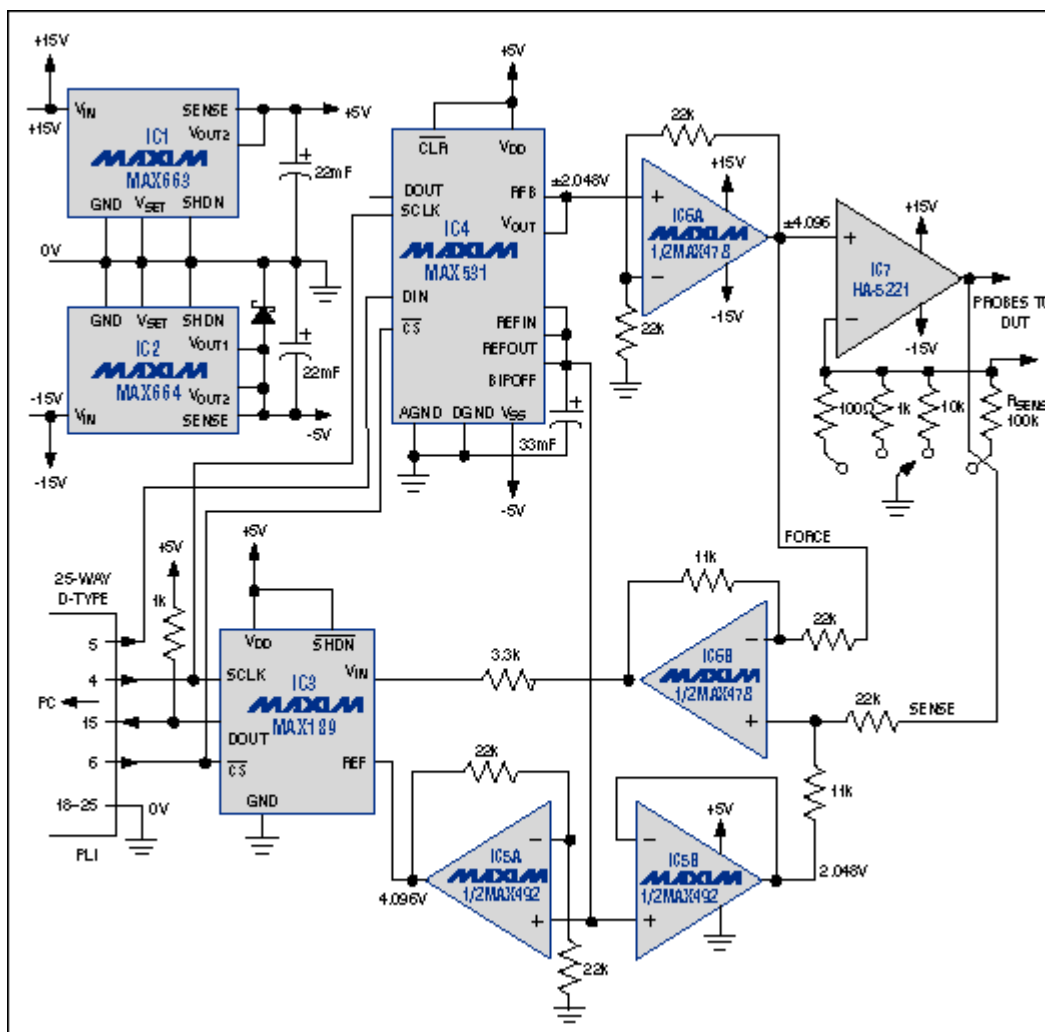


Figure 1. A 12-bit serial-data DAC (IC4) and ADC (IC3) form an interface that enables the printer port of a PC to control this I-V curve tracer.

The 12-bit digital-to-analog converter (DAC), IC4, is configured for bipolar outputs to $\pm 2.048V$. Op-amp IC6A multiplies this signal with a gain of $+2V/V$, and op-amp IC7 converts the result to a current that passes through the device under test (DUT). This current ranges from $\pm 40\mu A$ to $\pm 40mA$, according to the

resistor value selected for R_{SENSE} . For any combination of DUT and selected range, the maximum current available equals (approximately) the IC6A output ($\pm 4.096V$ max) divided by R_{SENSE} .

Current through the DUT produces a bipolar voltage that is sensed by the differential amplifier IC6B. To avoid the variable-offset error that would otherwise occur with a change in switch position, this amplifier's inverting-input signal is taken from the low-impedance, noninverting input of IC7 rather than its inverting input. The penalty for this choice is the fixed input-offset error of IC7.

The differential amplifier's gain plus the offset supplied to it result in a maximum output swing (0V to 4.096V) compatible with the unipolar input range of the 12-bit analog-to-digital converter (ADC), IC3. IC3's $3.3k\Omega$ input resistor limits input current in the event of an applied overvoltage. IC7 requires $\pm 15V$ supply rails to provide sufficient compliance voltage for its current-source function. To supply all the other ICs, IC1 and IC2 regulate these rails to $\pm 5V$.

During operation, the software drives the DAC to produce a current ramp, and the ADC measures the resulting voltage across the DUT. This voltage waveform is displayed on the PC monitor at 640x480 resolution, as shown in two examples (Figure 2). Twelve-bit converter resolution is excessive with respect to this display resolution, but 12 bits provides a margin for the use of higher-resolution monitors and for examining the response with a software "zoom."

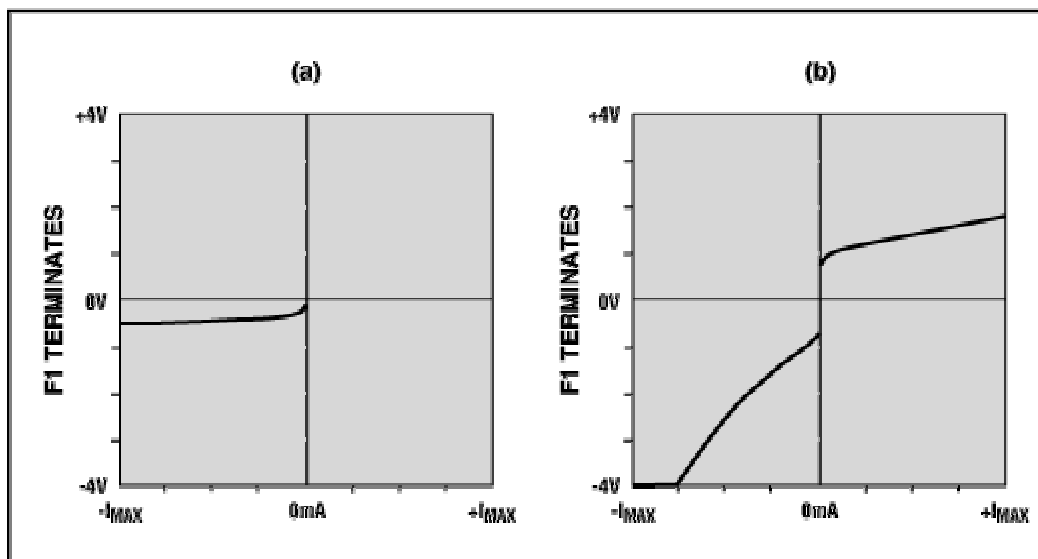


Figure 2. Examples of output from the Figure 1 circuit include a Schottky diode (a) and a more complex analog IC (b).

* [I-V Curve Tracer](#)

A similar version of this article appeared in the December 1997 issue of *Electronic Engineering* magazine.

Revision: July 2001

MORE INFORMATION

MAX189:	QuickView	-- Full (PDF) Data Sheet (192k)	-- Free Sample
MAX478:	QuickView	-- Full (PDF) Data Sheet (272k)	-- Free Sample
MAX492:	QuickView	-- Full (PDF) Data Sheet (240k)	-- Free Sample
MAX531:	QuickView	-- Full (PDF) Data Sheet (216k)	-- Free Sample
MAX663:	QuickView	-- Full (PDF) Data Sheet (376k)	-- Free Sample
MAX664:	QuickView	-- Full (PDF) Data Sheet (376k)	-- Free Sample