

# PULSE CURVE TRACER

## BARTH Model 4002 TLP+™ Specifications

### Barth 4002 TLP+™ (Pulse Curve Tracer)

The Barth 4002 TLP+™ Pulse Curve Tracer precisely characterizes the ESD robustness of silicon chip protection circuitry. Programmed rectangular pulses are applied to the device under test, resulting in a computerized plot of current vs voltage. A leakage measurement is made after each pulse to obtain the leakage evolution current versus pulse voltage. Set up for packaged device testing, an optional dual wafer probe (Barth Model 45002WP), permits wafer level testing as well.

### Barth Software

Barth's newest software now includes: Voltage & current DUT waveform capture; Automatic calibration / compensation (and save / recall); Save / recall operator set-ups; Auto or manual axis scaling; Single or multi-point leakage testing (configurable); Adjustable measurement window; Dynamic resistance calculator; Compare & analyze multiple tests; 2 or 4 channel scope (toggle); Save / recall pulsing "profiles"; Multi-pulsing capability (between data collection points); Scope auto-SPC (signal path compensation); and numerous other new features.

### Barth 45002WP Dual Wafer Probe (Option)

The Barth 45002WP Dual Wafer Probe is designed for pulse testing of the ESD protection I/V characteristics at the wafer level. It has two separate needles and isolated probe connections that can be independently positioned with no interaction between them. It has been specially designed to provide the same accuracy as when testing packaged devices in a socket. To minimize the mechanical problems of crossed needles in connecting to the pads to be tested, a specially designed constant impedance-reversing switch allows easy selection of the TLP pulse polarity at the pads. A strong magnetic or vacuum base allows this TLP probe to be easily moved while maintaining a secure position on the table. Options include: Insertion of series resistance to increase effective source impedance (see separate data sheet); connection to 3<sup>rd</sup> or 4<sup>th</sup> probes for applying bias voltages or to enable alternate pad leakage testing (see separate data and info sheets).



Printer and probe station not shown; front door removed

### How It Works

To use the Pulse Curve Tracer, the operator enters the desired test parameters via keyboard, such as starting voltage, current and voltage limits, voltage step increments, pulse risetime, and pulse width. The test then proceeds automatically, controlled by Barth software developed with National Instruments Labview®. The operator can halt and resume the testing and can view the plotted test data points as the test proceeds. The operator can also view (during testing or afterward), voltage & current waveforms, single point or multi-point leakage evolution, test set-up parameters, or numerical data information. The active test and several previous tests' data points may be viewed simultaneously on the I/V plot. Hardcopy prints are immediately available on the provided printer. This includes both the active I/V plus leakage plot, and/or the "print window" print which will print all information in that "window".

### System Components

System components include the Barth 40021 Control Box/Pulse Generator, a Tektronix 500 MHz, 2 channel, digitizing oscilloscope, a Keithley Picoammeter/Voltage Source, a Stanford Research Systems high voltage power supply, and a sliding drawer containing the Barth 44001A-48 DIP Test Fixture. External to the rolling test system cabinet is a Pentium PC, with high-resolution monitor, and a color printer. The computer and instruments are interfaced using GPIB.

### 50 ohm Test System

A controlled 50-ohm impedance throughout the complete measurement chain of the test system minimizes the measurement errors associated with the usual 500-ohm resistor connections for ordinary TLP testers. Making measurements at 50-ohm impedance minimizes the effects of parasitics.

Just as the Barth 4002 TLP Pulse Curve Tracer connections to the packaged device sockets are constructed with a controlled 50-ohm impedance, the Barth TLP wafer probe also has a controlled 50-ohm impedance throughout its connections to the two needle contacts at any two pads.

Testing the DUT directly from an inherently low 50-ohm source impedance provides inherently higher pulse currents from a clean test pulse with no ringing or overshoot. A perfect sub nanosecond risetime pulse generator combined with low distortion measurement probes and controlled impedance connections allows the Barth Pulse Curve Tracer test system to gather accurate TLP data either on wafer or on packages.

### Accuracy

Special Barth wide bandwidth pulse current and voltage sensors provide a high standard of measurement capability for ESD test equipment. The complete system has been built with special attention paid to minimizing losses in the test circuitry and the coaxial cable connections. This results in low internal resistance at the device under test (DUT), for high accuracy measurements.

## Barth 4002 TLP+™ Pulse Curve Tracer - Specifications

### Output to DUT (program driven)

**Pulse width:** 75ns to 150ns (standard). 500 ns option available. The standard of 100ns (plus 75ns) is supplied with the tester. Pulse width is manually selectable.

**Pulse voltage:** 0-250 v @ 50Ω load, 500 v @ open circuit (step increments: ≥0.05v)

**Pulse current:** 0-5 amps @ 50Ω load, 10 amps @ short circuit, Note: 20 amp option available

**Pulse risetime (10-90%):** 0.2, 2, 10 ns (built-in, software selectable) or optional external risetime filter accessory

**Pulse rate:** ≈ 10 test pulses per minute

**Leakage voltage:** 0 to 100v (0.1 v increments)

**Leakage current sensitivity:**  $10^{-12}$  to  $2.5 \times 10^{-3}$  amps

**Source impedance:** 50Ω

**Load Impedance:** any load

**Factory Selectable power:** 100,120 vac@5amps; 220,240 vac@3amps, 50 to 60 Hz (USA default:120 vac; 60 Hz)

**Size:** 22"W x 38 5/8"H x 25 7/8" D (rolling rackmount cabinet)

**Weight:** 222 lbs (not including external PC, monitor, and printer)

### Accessories

The 48 pin DIP Test Fixture (included) can accommodate .300" and .600" width packages. It can be used for smaller DIP packages with the use of pin renumbering overlays (overlays for 8, 14, 16, 20, 24, 28, 32, 40, and 44 pins are provided). The test fixtures are conveniently located in a pullout drawer, and have clearly numbered pins with easy test pin lead selection.

### Options

An available Wafer Probe, with dual balanced needles, specifically designed with minimum parasitics for TLP testing, has an arm length of 4.5". The Wafer Probe includes a two-part DUT cable set (length = 48"). Wafer Probe 2" arm extensions are also available. Another option for the Wafer Probe, the High Z option, offers series resistors.

Barth also offers the following options; Negative Pulse, Wide Pulse, 20 Amp, 30 Amp, a 441 pin PGA Test Fixture, and a 20ns, 30ns or 40ns Spoiler Kit(s). Custom test fixtures are available by special request.

### Data Storage

Data is automatically stored to hard disk in comma delimited format and can be recalled for viewing or transferring to disk. Data is automatically time/date stamped when saved.

### Hardcopy Printout

Hardcopy printouts on a color printer listing data point values and showing plotted results using operator selected scaling are immediately available in a presentation ready format at the end of a test. The "Print TLP Results" printout is shown below. (on the left).

### Screen Displays

One of the 8 display screens is shown below (on the right). Seven other screens all display the active test and up to 5 recalled tests (on the left half of the screen). The left side display shows the I/V curve and leakage evolution. The right side display can also show: V & I waveforms, single or multi-point leakage evolution, operator info, test parameters, numerical test-point data, or calibration values.

