

# SafeTest™ Protection Technology

For Accurate, Reliable, and Safe Testing of Today's New Low Voltage Technologies

- Automatic driver verification
- Backdrive current sensing
- Closed-loop, low impedance drivers
- Multi-level digital isolation software
- Per-pin programmable logic thresholds and timing
- Programmable backdrive current and duration thresholds
- Specialized digital controller



## New Voltage Technologies

Today's low voltage technology devices are fueling exciting consumer products that are smaller, have increased power, and have longer battery life. A look at the technology roadmaps of the major semiconductor manufacturers reveals a decade-long progression toward lower logic voltage thresholds. For instance, Texas Instruments has introduced products with logic voltage thresholds ranging from 5V to 3.3V to 2.5V, all the way down to 0.8V. At the same time, voltage levels on Intel processor chipsets have also declined with each successive processor generation to the point where Intel currently employs four different low voltage logic thresholds on their Pentium chipsets.

## Danger: Low Voltage

While the new technology has been a boon to consumers, it poses significant challenges to electronics manufacturers utilizing conventional in-circuit test (ICT) solutions. The reduction of power supply voltages and transistor geometry over the last few years has increased the accuracy requirements of in-circuit drivers and sensors. This has made low voltage components more difficult to test reliably and more susceptible to damage from over-voltage and over-current test conditions. These conditions can occur routinely on conventional in-circuit testers and can cause low voltage devices to be immediately destroyed or damaged in ways leading to

early-life product failures in the field. Use of conventional in-circuit test systems can result in damaged components, untestable components, increased false failures, and unnecessary repair/rework operations – adding costs that can be financially devastating to companies operating at tight profit margins.

## The SafeTest Protection Technologies Solution

The patented hardware and software features of SafeTest protection technologies make Teradyne's TestStation™ in-circuit test systems the industry's best ICT solution for safely and reliably testing today's new low voltage technologies. SafeTest protection technology is made up of a powerful combination of Teradyne's patented UltraPin™ digital pin electronics and key TestStation software features.

SafeTest protection technologies assure product quality and reduce overall product costs by providing the voltage accuracy, backdrive current measurement, and multi-level isolation techniques that are necessary to perform accurate, reliable, and safe powered-up testing of today's new low-voltage devices. SafeTest features include:

**Automatic Driver Verification** - Automatic driver verification capabilities ensure that each driver achieves its programmed voltage value and improve diagnostics by identifying board conditions that prevent a tester driver from reaching its programmed value.

**Real-Time Backdrive Current Measurement Capabilities** - Teradyne's in-circuit drivers are able to perform real-time measurements of backdrive currents and duration. This allows the tester to identify test conditions that require unusually large backdrive currents and highlight areas of the test program that have missing or inadequate device isolation steps.

**Closed Loop, Low Output Impedance Drivers** - Teradyne's TestStation in-circuit test systems have specified driver accuracy below 50mV and output impedance of less than 1 ohm. This means that the driver is capable of accurately testing today's low voltage technologies, under both no-load and backdrive conditions, and that it is well-equipped to handle the challenges of future low voltage devices.

**Multi-Level Digital Isolation** - High-performance test generation and circuit analysis software automatically disables or inhibits any outputs on the PCB connected to nets that are being driven. This capability is critical to avoiding potentially harmful voltage spikes that can cause CMOS latchup when an output being backdriven suddenly changes its logic state.

**Per Pin Programmable Logic Level Assignments** - Driver/sensor (D/S) pins allow individual, rather than group, programming of logic level thresholds, backdrive limits, and slew rates. Per pin programmable D/S capabilities allow the programmer and test generation software to assign logic levels appropriate for each pin on the device and avoid test compromises that can occur on in-circuit testers that must share logic level assignments.

**Programmable Backdrive Currents and Duration** - Programmers are able to set the maximum backdrive current and time allowed on each device pin during its test. This can be used to protect sensitive device technologies from being overstressed when there is a fault condition on the board. This feature can also be used to identify faults not normally detected by conventional in-circuit testers, such as faulty enable pins and marginal output transistors.

**Specialized Digital Controller and Timing** - Dedicated digital controller hardware is capable of quickly executing digital test vectors with consistent and repeatable test timing. Testers with specialized digital controllers benefit from faster digital test throughput, less component backdrive stress, and more repeatable test results.

Feature	TestStation with SafeTest Technologies	Conventional In-Circuit Testers
D/S Accuracy	<ul style="list-style-type: none"> <li>&lt;45mV No load driver error</li> <li>&lt;300mV driver error @500mA</li> <li>Automatic driver verification</li> <li>&lt;45mV sensor error</li> </ul>	<ul style="list-style-type: none"> <li>&gt;100mV no load driver error</li> <li>&gt;2.5V driver error @500mA</li> <li>No automatic driver verification</li> <li>&gt;300mV sensor error</li> </ul>
Backdrive Detection/Control	<ul style="list-style-type: none"> <li>Real-time current sensing</li> <li>Programmable backdrive current</li> <li>Programmable backdrive time</li> </ul>	<ul style="list-style-type: none"> <li>Cannot sense backdrive current</li> <li>Cannot program backdrive limit</li> <li>Cannot program backdrive time</li> </ul>
Logic Levels	<ul style="list-style-type: none"> <li>Programmable per pin</li> <li>Dual-Level thresholds</li> <li>-2.5V to 5.5V voltage range</li> </ul>	<ul style="list-style-type: none"> <li>Logic levels shared by pin groups</li> <li>Single level threshold</li> <li>0 to +5V voltage range</li> </ul>
Digital Test Controller	<ul style="list-style-type: none"> <li>Dedicated digital controller</li> <li>Fast application of test vectors</li> <li>Consistent timing</li> </ul>	<ul style="list-style-type: none"> <li>Shared PC processor</li> <li>Slow application of test vectors</li> <li>Inconsistent timing</li> </ul>
Test Quality Tools	<ul style="list-style-type: none"> <li>AutoDebug software</li> <li>AutoAdjust software</li> <li>Throughput optimization</li> <li>Validated test coverage</li> </ul>	<ul style="list-style-type: none"> <li>Learn mode</li> <li>Widen test limits</li> <li>No test optimization</li> <li>Calculated test coverage</li> </ul>
Digital Isolation	<ul style="list-style-type: none"> <li>Multi-level digital isolation</li> <li>Automatic test generation</li> <li>Smart isolation sequences</li> </ul>	<ul style="list-style-type: none"> <li>Single-level digital isolation</li> <li>Manual test generation</li> <li>Random isolation sequences</li> </ul>

