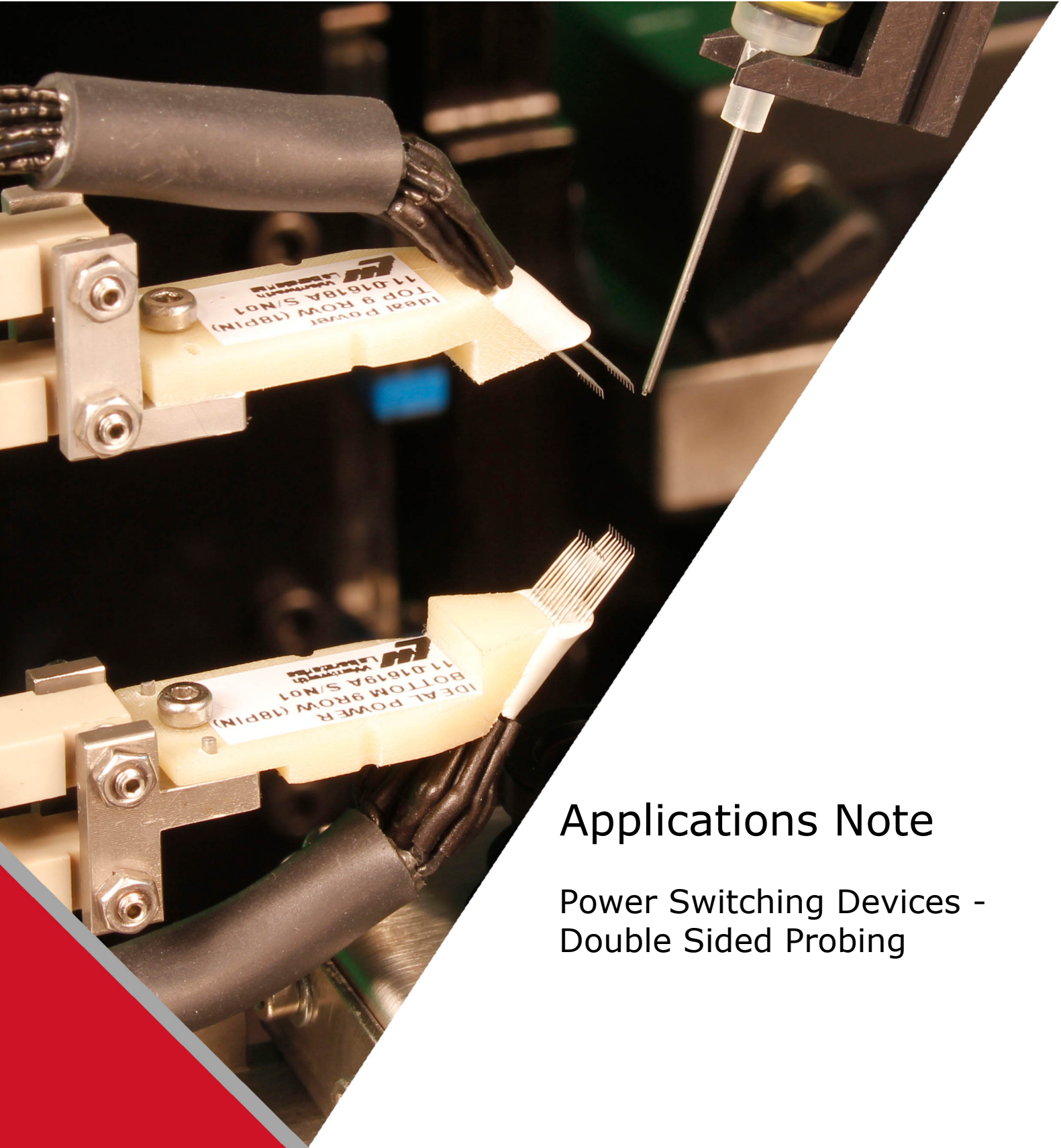

Applications Note

Power Switching Devices - Double Sided Probing

Wentworth Laboratories

Power Switching Devices - Double Sided Probing

As switching time and R_{DSON} of power devices (MOSFETs and IGBTs) has steadily reduced, that progress has been accompanied by a problem related to producing "known good die".

Many high-performance die today are used in power modules with multiple die per module. The costing of re-working modules to replace die that do not meet specification for switching speed or R_{DSON} is unacceptable in today's competitive markets where devices require less than 2mΩ.

The problem of accurately measuring the switching time of a power device on a conventional wafer prober, relates to the electrical connection of the tester to the drain or collector via the vacuum chuck plate. As shown in figure 1, the conventional connection method of this vacuum chuck introduces a variable inductance electrically in series with the device that is being probed, that compromises the accuracy of any attempt to make dynamic measurements. This inductance varies depending of the position of the die on the wafer, relative to the vacuum chucks' electrical connections.

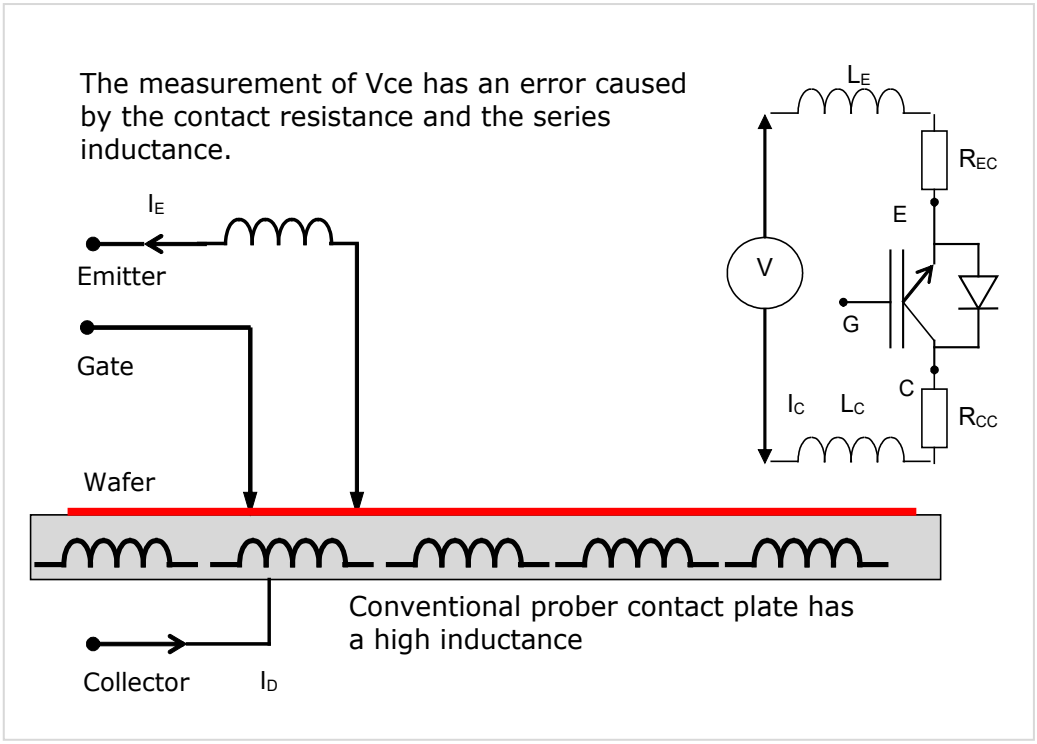

Figure 1

Double sided probing

Wentworth has developed a conceptually simple solution to the above problem – probe the wafer from both sides. The probe head is shown in figure 2 with its multi-probe (Kelvin) connection, which also allows more accurate measurement of low resistivity such as Low R_{DSON} (shown in figure 3). The caliper arm assembly replaces the conventional chuck so the wafer remains constant in the z-axis while to top and bottom needles sets effective Z-up & Z-down. As shown below this means the probes of the underside probe head always make direct contact with the die being probed on the topside of the wafer. The series inductance is effective removed and the line resistance is constant and therefore can be calibrated out of the test results.

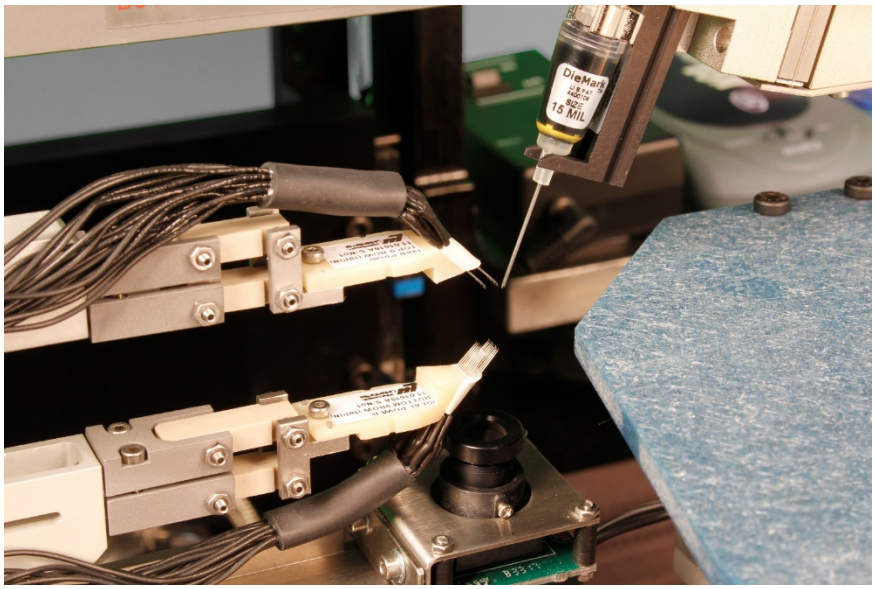

Figure 2

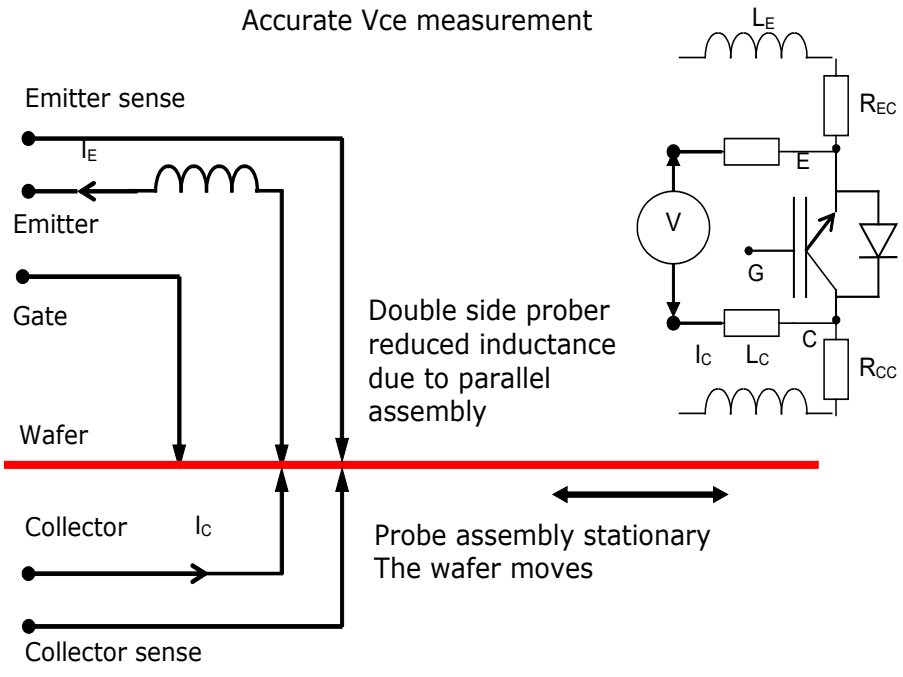

Figure 3

Test solutions

Wentworth has worked with a number of industry leaders including ipTEST to provide customers with a turnkey solution to power device probing. The ipTEST Mostrak system and Wentworth double sided probing solution's effectiveness can be obtained by comparing the switching waveforms for a packaged device and die on a waveform – these are shown in figure 4.

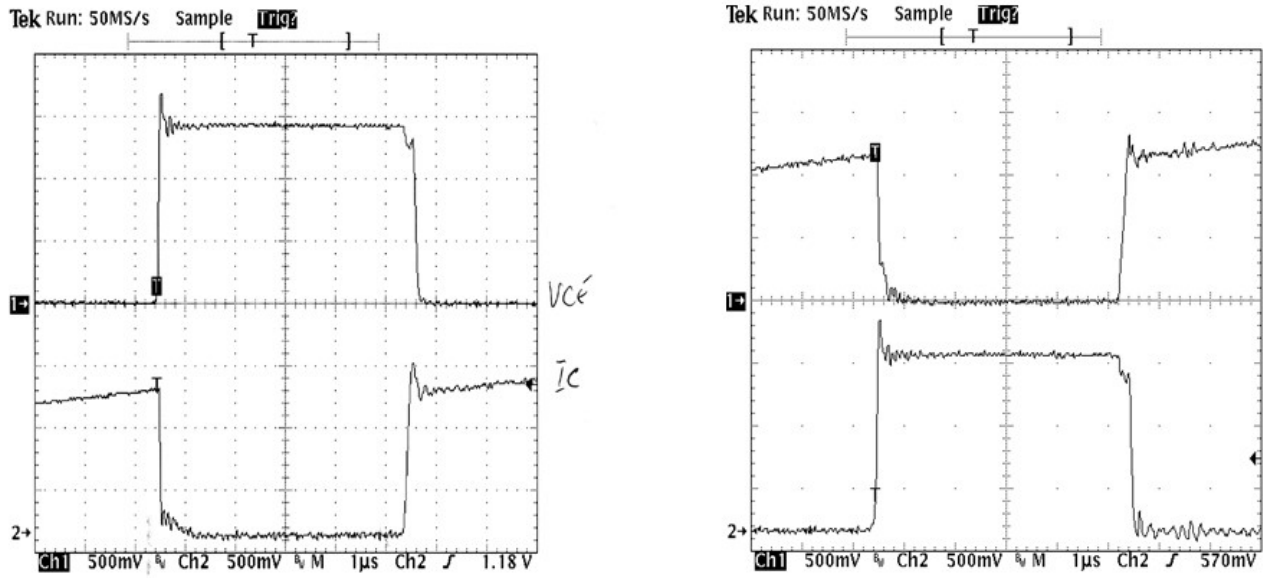

Figure 4

As can clearly be seen above, the normal method of wafer probing will introduce increased inductions into the test circuit, resulting in slower dynamic switching times and lower accuracy results. Improved chuck plate manufacturing techniques, as well as modified vacuum patterns for wafer hold-down on chuck, does improve the measurement capability. However, direct probe contact provides a significant improvement in test performance.

The Pegasus™ S200D and A200D systems provide the ideal solution for power switching device testing at wafer level.