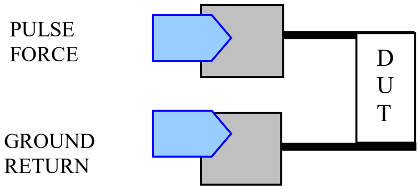
TECHNICAL NOTE #400

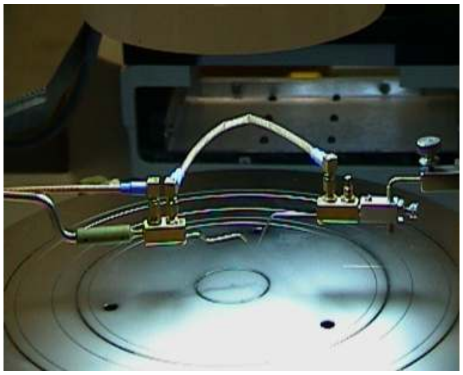
Proper selection of wafer probe configuration for TLP testing

When testing at the wafer level, TLP and VF-TLP measurements require the appropriate probe needle configuration, based on the risetime and duration of the pulse. The type of wafer probes used to deliver the pulse as well as the configuration of TLP will limit the accuracy of the measurement for the specific test configuration. This Technical Bulletin describes several available wafer probes and explains the TLP configurations that can be best used for Standard TLP and VF-TLP.

STANDARD TLP

Standard TLP is characterized by relatively long duration pulse widths, typically greater than 50 ns, with 100 ns being a common value. For wafer level TLP, the wafer probe performance plays a major role in measurement. Time Domain Reflection (TDR-O) remains the most common Standard TLP configuration and requires only a basic two needle probe arrangement. This setup provides adequate measurement accuracy for most applications, but other configurations for are possible and each has specific wafer probe requirements.



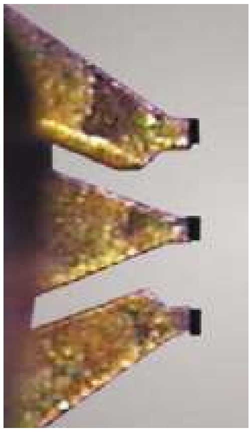


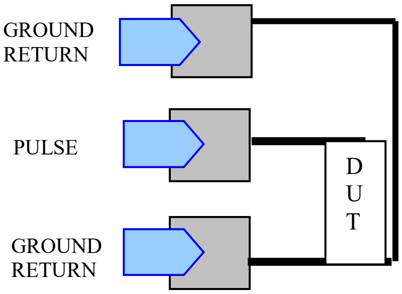
VF-TLP

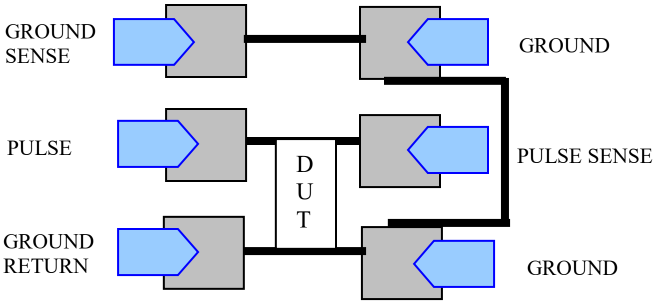
Very fast TLP is characterized by short pulse width, typically less than 10 ns and possibly as short as 1.5nS. This means measuring the DUT performance within 100s of picoseconds to a few nanoseconds after the pulse leading edge. The measurement accuracy of a pulse with a measurement window measured in 100s of picoseconds requires high frequency measurement capability probe needles, the current and voltage probes and oscilloscope. The interface between the VF-TLP test system and the wafer must have low parasitic inductance and capacitance. For wafer level VF-TLP, the wafer probe performance plays a major role in measurement. While Time Domain Reflection (TDR-S) remains the primary Standard TLP configuration, other configurations for VF-TLP are possible and each has specific wafer probe requirements.

TDR measurements with acceptable measurement performance and low noise characteristic can be made with a dual, high frequency G-S probe configuration.

For maximum flexibility in probe placement, a high frequency 50 Ohm probe pair can be used for pulse width down to 5 nS in a TDRT 100 Ohm configuration. For better performance however, G-S-G or Kelvin probe needle sets may be used. The more complex wafer probes needles provide enhanced measurement accuracy but may require specific wafer pad layouts. Specifically, the test die may require oversized or dual pad sets to accommodate the probe needle configuration.

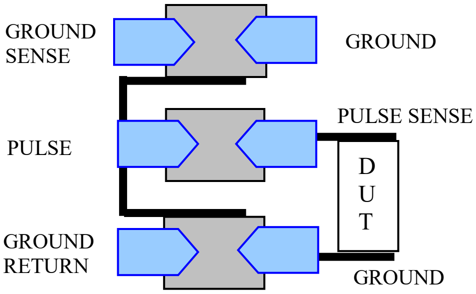






GSS

GSG with High Impedance Signal Path



GSS

GSG with High Impedance Signal Path

Probe type	Probe Band-width	TLP Pulse Widths	TLP Configuration & Impedance	Flexibility
Ground Signal (GS or SG configurations)	40 GHz	≥2.5 ns	**TDR** 50 Ohm	Needles must match pad spacing. Ground pad must be next to pulse pads.
Ground, Signal, Ground (GSG)	40 GHz	≥2.5 ns	**TDR** 50 Ohm	Needles must match pad spacing. Ground pads on both sides of pulse pads.
2 probes (a GSS and a special 1KΩ GSG)	40 GHz	≥1 ns	**Kelvin TLP** ~ 50 Ohm (4-point measurement)	Lowest flexibility. Needles must match pad spacing. Ground pads on both sides of pulse pads. Pads wide enough to place two set on needle.

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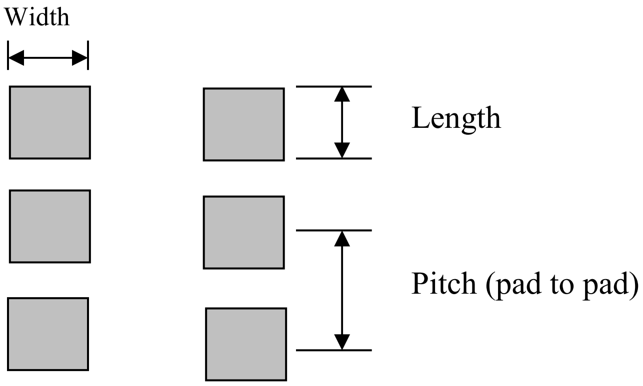
Two Row Configurations



Pad Configuration ☐ Single Row ☐ Dual Row (Kelvin Connection)

Pad Dimensions (microns) ______ Width ______ Length

Note: For single pin per pad contact, minimum dimensions are:
For dual pin per pad contact, minimum dimensions are:

Are pulse pads next to their associated ground pads? Yes No

Pad Material Gold Aluminum

Circle tip configuration: GSG GS SG

Circle required pitch (center to center in microns):

100 125 150 200 250

350 400 450 500 Other

TECHNICAL NOTE #400 Rev x ____R. Given_____ __ 3/30/2010__
Name Date