

## CHARM<sup>®</sup>-2 vs. "Antenna" Capacitors

Due to frequent inquiries, we provide this brief summary of the major differences between CHARM-2 charging monitors and "antenna" capacitors monitors.

### CHARM-2 MONITORS:

Measure the **causes** of charging damage: wafer surface-substrate potentials, charge-fluxes, and UV dose.

Provide understanding of underlying causes.

Calibrated sensors, standard measurements  
⇒ Repeatable results.

Easy to compare results from different sources.

Results do not depend on gate oxide thickness.

Provide J-V characteristics of charging source  
⇒ Enable damage prediction.

Analog measurements results.

Wafer maps of potentials, charge-flux, and UV dose from single wafer.

Single-wafer/experimental split.

Separate measurements of UV and electrostatic effects  
⇒ Improved problem diagnosis.

Peak-value sensors ⇒ Short exposure sufficient.

**Re-usable.**

Potential sensors more sensitive than "antenna" capacitors, regardless of "antenna" ratio.

### "ANTENNA" CAPACITORS:

Measure the **effect** of wafer charging: provide count of damaged capacitors.

Provide no understanding of underlying causes.

Not calibrated; results depend on measurement parameters, capacitor structure, and gate oxide quality  
⇒ Inconsistent results.

Difficult to compare results from different sources.

Results depend on gate oxide thickness.

Cannot provide J-V characteristics of charging source  
⇒ Damage prediction not possible.

Need extensive damage statistics.

Meaningful maps of damage regions over the wafer not possible unless large number of wafers are superimposed.

Multiple-wafers/experimental split.

Do not distinguish between UV and electrostatic damage  
⇒ Confusion regarding possible causes.

Integrating detectors ⇒ Full-process necessary.

Throw-away (damaged).

**For additional information, please contact:** **Dr. Wes Lukaszek**  
**Wafer Charging Monitors, Inc.**  
**127 Marine Road**  
**Woodside, CA 94062**  
**tel. (650) 851-9313 fax. (650) 851-2252**