FSM RsL100 Sheet Resistance and Leakage Current Mapping Tool

Non-contact Sheet Resistance and Leakage Current Measurements for Implant & Annealing Monitoring for 65 and 45 nm CMOS Technologies

Principle of Measurement:
The RsL100 mapping tool uses a non-contact method for determination of sheet resistance and leakage current density which combines photo-generation of carriers with analysis of amplitude and phase of junction photo-voltage (JPV) measurements. The RsL probe consists of an intensity modulated light beam and two capacitive electrodes (Fig. 1).

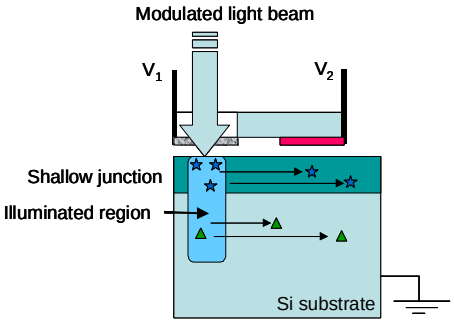

Figure 1. FSM RsL100 sheet resistance and leakage current probe showing creation of carriers under the light beam and carrier drift under the two voltage probe electrodes.

Electron-hole pairs are created by the absorbed photon energy in the illuminated region. The carrier diffusion and drift is monitored at the transparent (V_1) and offset (V_2) electrodes. The voltage under a probe follows Eg. 1 (in a simplified, 1-dimensional model).

$$V = A*e^{-\mathbf{k}x} \qquad \text{(Eq. 1)}$$

where:

x = distance of probe from illuminated region

$\mathbf{k} = [R_S*G + i\,\omega*R_S*C_S]^{1/2}$

R_S = junction sheet resistance

G = junction conductivity

C_S = substrate capacitance

ω = 2π*light modulation frequency.

By analysis of the amplitudes and relative phases of the JPV signals as a function of light modulation frequency, the junction conductivity, G, can be determined in addition to the junction sheet resistance, R_s. The junction conductivity and leakage current density, I_o, are related by (Eg. 2),

$$G = I_o*(q/kT) \qquad \text{(Eg. 2)}$$

where: G = junction conductivity

I_o = junction leakage amplitude

q = electron charge

k = Boltzman's constant

T = wafer temperature (K)

I = p-n junction leakage current density

$= I_o*[e^{(qV/kT)} - 1]$

V = junction bias voltage.

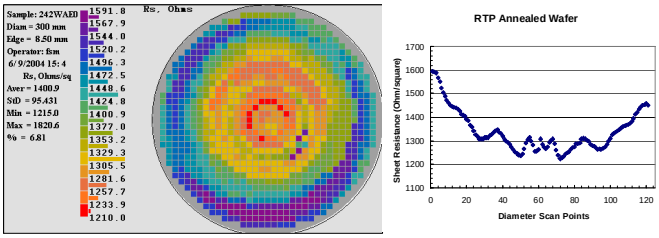

Figure 2. Rs map (left) and diameter scan (right) for an RTP annealed shallow junction (~20 nm) with strong local heating non-uniformities.

Specifications:

Measurements:

Sheet Resistance: 10 to >100,000 Ohms/square

Rs Repeatability: <0.1% (100 cycles)

Leakage Current: 10^{-7} to 10^{-3} A/cm^2

Process Range:

Junction depth: 10 nm to >2 um

Dose: 10^{11} to >10^{15} ions/cm^2

Contour & color maps, line scans

Throughput:

973 point maps in <2.5 min

Footprint:

300/200 mm dual FOUP:

1.16 (width) x 2.01 (Depth) m

300/200 manual loaded:

0.67 (width) x 0.92 (Depth) m

Configurations:

The RsL tool is available in semiautomatic (manual wafer loading) and cassette-to-cassette (C2C) versions for 200 and 300 mm wafers.

RsL100
300 mm
Sheet Resistance
& Leakage Current
Mapping tool.

(single FOUP version)

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