Precise data acquisition
Endless pursuit for reliability
The Oxide Film Property Evaluation System

As wafer size is enlarged for mass production of high-density, high-function LSIs, reliability evaluation of oxide film is on increasing demand, which is key for LSI reliability. ESPEC'S TDDB Evaluation System will play an indispensable role for analyzing failure caused by pressure resistivity of thin insulation oxide film and characteristics and flattening of oxide film, at wafer, glass substrate, and package level.
MEASUREMENT EVALUATION SYSTEMS

- CONDUCTOR RESISTANCE EVALUATION SYSTEM
- ION MIGRATION EVALUATION SYSTEM
- INSULATION RESISTANCE EVALUATION SYSTEM
- LOW-K INSULATION CHARACTERISTIC EVALUATION SYSTEM
- LEAK CURRENT MEASUREMENT SYSTEM
- CAPACITOR TEMPERATURE PROPERTY EVALUATION SYSTEM
- LASER DIODE AGING SYSTEM
- INTERCONNECTION MEASUREMENT EVALUATION SYSTEM
- ELECTRONICS PARTS ELECTRIC PROPERTY AUTOMATIC EVALUATION SYSTEM
- TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR TEMPERATURE PROPERTY TEST SYSTEM
- OPTICAL COMPONENT ENVIRONMENTAL TEST SYSTEM
- ELECTRO-MIGRATION EVALUATION SYSTEM
- TIDDB EVALUATION SYSTEM
- SEMICONDUCTOR PARAMETER AUTOMATIC EVALUATION SYSTEM
- COMBINED ENVIRONMENTAL TESTING, MEASUREMENT & EVALUATION SYSTEM

- THROUGH-HOLE CONDUCTOR EVALUATION SYSTEM
- SOLDER-JOINT CONTACT EVALUATION SYSTEM
- BGA, CSP SOLDER JOIN CONTACT EVALUATION SYSTEM
- CONNECTOR CONTACT RESISTANCE EVALUATION SYSTEM
- FPC LIFE EVALUATION SYSTEM
- OTHER INTERCONNECTION MATERIAL CONTACT EVALUATION SYSTEM

- CAPACITOR INSULATION RESISTANCE EVALUATION SYSTEM
- PCB, PWB INSULATION RESISTANCE EVALUATION SYSTEM
- INSULATION RESISTANCE EVALUATION SYSTEM FOR OTHER INSULATION MATERIAL

- CAPACITOR LEAK CURRENT MEASUREMENT SYSTEM
- FET LEAK CURRENT MEASUREMENT SYSTEM
- SEMICONDUCTOR REVERSE BIAS LEAK CURRENT MEASUREMENT SYSTEM

- CONNECTOR DISCONNECTION EVALUATION SYSTEM
- SOLDER-JOINT DISCONNECTION EVALUATION SYSTEM
- HARNESS CONTINUITY EVALUATION SYSTEM

- LSI ELECTRO-MIGRATION EVALUATION SYSTEM
- GMR HEAD ELECTRO-MIGRATION EVALUATION SYSTEM
- GMR HEAD ELECTRO-MIGRATION RH EVALUATION SYSTEM
- HIGH FREQUENCY ELECTRO-MIGRATION EVALUATION SYSTEM
- WAFER LEVEL
- PACKAGE LEVEL

- FET (HOT CARRIER) PROPERTY EVALUATION SYSTEM
- TRANSISTOR PROPERTY EVALUATION SYSTEM

- AUTOMATED RESONANCE POINT SEARCH & MEASUREMENT SYSTEM
System configuration to fit number of measurement

Equipped with DC Multi Source Measurement (MSM) on each channel, which enable monitoring and output of voltage and current. MSM consists of 4 channels per board. The basic 40-channel configuration stores up to 10 boards. The system can be upgraded according to measurement volume and condition up to 5 units (200 MSMs).

Precise current and voltage application measurement

Current at 9 ranges, measurement resolution of maximum current \( \geq 100\text{mA} \), and minimum current \( \geq 1\text{pA} \). Voltage at 2 ranges, resolution of maximum voltage \( \geq 50\text{V} \) and minimum voltage \( 1\text{mV} \). Enables a wide range and precise application and measurement.

Measurement at minimum 10msec

Delivers high-speed measurement for multiple channels. Measures at top speed of 10msec per 40 channels, while acquiring data.

Various evaluation items

The TDBB Evaluation System is configured for wafer level and liquid crystal glass substrate level, by effectively systemizing MSM. It also applies for requirements of QDB evaluation and TZDB evaluation, while FET property evaluation can also be realized by exchanging software.

Output by CSV file

Automatic compilation of CSV file enable output by normal plotting. (Spread sheet software Microsoft EXCEL data can also be converted)

LAN compatible

Expansion to high-voltage load

To upgrade the system, we provide MSM boards designed specifically for a maximum + 100V high-voltage load.
SYSTEM BLOCK DIAGRAM

- **Uninterruptable power supply**
  Backup power supply for controller (Does not reset automatically when power restored)
- **MSM unit**
  Incorporates 40ch MSMs per unit (maximum 5 units)
- **Connection BOX panel**
  Can be set as panel for prober shield BOX.
- **Triaxial cable**
  Connects specimen and MSM to reduce noise level.
- **Chamber**
  Evaluation at package level of specimen, under high temperature, using the TEG board.
- **E-BUS**
  Temperature control, monitor, alarm control of chamber with a GP-IB adapter.

CONNECTION TO A PROBER

- **Prober**
  Type1
  Wafer level prober
  For both 5 inch type and 8 inch type
  Compatible with 300mm wafer type full automatic prober
  Type2
  Liquid crystal glass substrate (maximum 500-400mm)
- **Hot chuck**
  Compatible prober:
  maximum 300 for wafer level
  maximum 150 for liquid crystal glass substrate.
- **Probe card**
  We offer optimum probe card to meet required specification and layout such as number of channels, pins and wafer size. Enables whole contact with a single shot.
## SPECIFICATION

### Model

<table>
<thead>
<tr>
<th>AMM-1000</th>
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</thead>
<tbody>
<tr>
<td>Software</td>
</tr>
<tr>
<td>Voltage/current application range</td>
</tr>
<tr>
<td>Resolution</td>
</tr>
<tr>
<td>Voltage/current measurement range</td>
</tr>
<tr>
<td>No. of measurement channels</td>
</tr>
</tbody>
</table>

### Measurement sampling speed

- **Short mode:**
  - 0 to 100μsec: 10μsec interval
  - 100μsec to 10sec: 100μsec interval
  - Over 10sec: according to table below

- **Medium mode:**
  - 0 to 100μsec: 20μsec interval
  - 100μsec to 10sec: 100μsec interval
  - Over 10sec: according to table below

- **Long mode:**
  - 0 to 10sec: 100μsec interval
  - Over 10sec: according to table below

<table>
<thead>
<tr>
<th>Time table</th>
<th>Measurement interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10 sec]</td>
<td>[1 sec] multiply by: 1, 2, 5 or 10</td>
</tr>
<tr>
<td>[100 sec]</td>
<td>[10 sec] multiply by: 1, 2, 5 or 10</td>
</tr>
<tr>
<td>[1000 sec]</td>
<td>[100 sec] multiply by: 1, 2, 5 or 10</td>
</tr>
<tr>
<td>[10000 sec]</td>
<td>[1000 sec] multiply by: 1, 2, 5 or 10</td>
</tr>
</tbody>
</table>

### External dimension

- **MSM unit:**
  - System controller

- **Required utility:**
  - 650W 1300H 800Dmm
  - 570W 1100H 900Dmm
  - 100V AC 10% 50/60Hz 15A
  - 100V AC 10% 50/60Hz 50A

### MSM Simplex Performance

- **Voltage range**
  - 10V
  - 50V

- **Resolution**
  - 1mV
  - 10mV

- **Accuracy**
  - (0.2% + 10mV)
  - (0.2% + 50mV)

- **Max. current**
  - 100mA
  - 50V

### Option

- **Wafer prober (8 inch, 12 inch)**
  - *Utility for prober differs according to type of prober. We can coordinate your system accordingly.*

  - **8 inch**
    - **Prober external dimension**
      - Manual prober 750W 1500H 800Dmm
      - Semi-auto prober 1100W 1600H 900Dmm
      - Full auto prober 1000W 1200H 1000mm
    - **Temperature range**
      - MAX + 300 Resolution 1 step
    - **Required utility**
      - 200V AC 10% 50/60Hz 30A 1

- **Prober for liquid crystal**

- **Prober card**

- **Chamber**
  - **Chamber external dimension**
    - 750W 1500H 800Dmm
  - **Temperature range**
    - MAX + 250 Resolution 1 step
  - **Required utility**
    - 200VAC 10% 50/60Hz 20A 1

- **Applied voltage, + 100V Specification**
Execute test by selecting from the following measurement mode library.

- **Fixed Voltage Measurement Mode**
  - Measured with fixed voltage stress. The measurement current and breakdown time are stored.
  - Applied voltage vs. Measurement vs. Time graph.

- **Soft Breakdown Mode**
  - Measured by changing stress voltage and measurement voltage. The voltage measurement can be adjusted in 5 steps.
  - Applied voltage vs. Time graph.

- **Current Stress Measurement**
  - Voltage is measured by applying fixed current. The default time is recorded and stored.
  - Fixed current (Application of fixed density current) applied for default time.
  - Measured voltage vs. Time graph with t = Time in seconds.
  - Considered as breakdown when ratio of two continuous measurement values is above $E_{EG}$ electric field strength ratio.

- **Step Voltage Measurement**
  - (I-V characteristics measurement, TZDB method)
  - Measures the current at each voltage level while increasing voltage application stepwise.
  - Voltage vs. Time graph with voltage steps and $dV/dt$.

- **Step Current Measurement (TZDB)**
  - Measures time dependent change of voltage while increasing current application stepwise.
  - Test is terminated if a failure is detected.
  - Applied current vs. Time graph.
  - Measurement is terminated if no breakdown is detected within $T_{max}$.

**Two-Step Current Stress Measurement**
- Different fixed current is applied two times (When breakdown does not occur the first time, the second test round is started)
- First round
  - Application of fixed density current at $Q_{b1}$ = Applied current density 1 $I_{b1}$
  - Measured voltage vs. Failure time in seconds $t_1$
  - Considered as breakdown when ratio of two continuous measurement values is above $E_{EG}$ electric field strength ratio.

- Second round
  - Application of fixed density current at $Q_{b2}$ = Applied current density 2 $I_{b2}$
  - Measured voltage vs. Failure time in seconds $t_2$
Specifications are subject to change without notice due to design improvements.

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