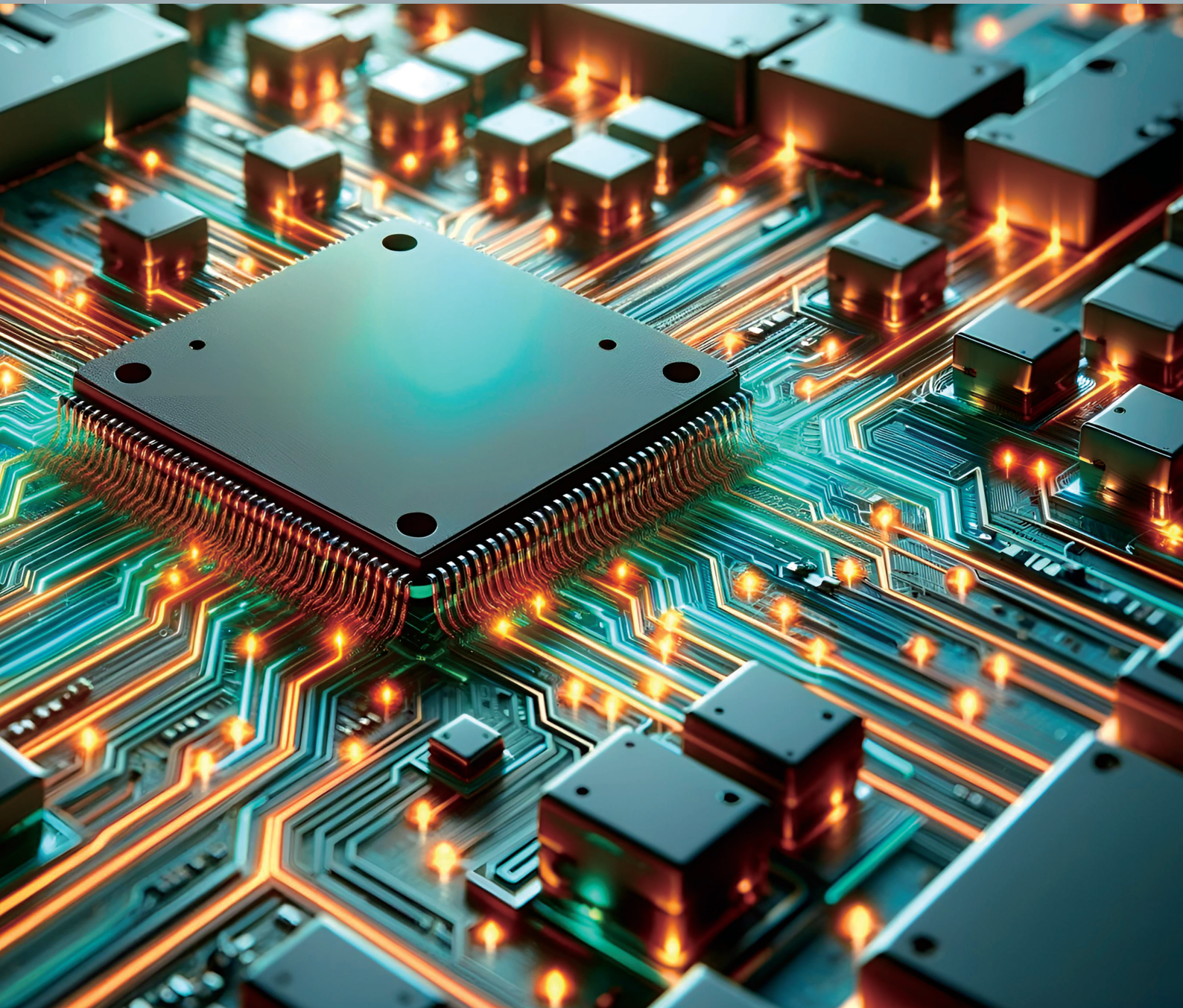


Quality is more than a word

ESPEC



“Thermal management” is the Key for the future of semiconductors.

Advanced Semiconductor Testing Equipment

The high-speed processing and advanced functionality of semiconductors significantly impact thermal design challenges.
 “Thermal management in semiconductors is essential for performance enhancement, reliability assurance, and product longevity.”
 ESPEC proposes and supports optimal evaluation methods for semiconductor assessment in thermal management.

Process	Front-end process		Back-end process	Inspection
Technology trend	Development of leading-edge processes of 2 nm level.		Chiplet and heterogeneous technology	The screening process and final inspection
	<ul style="list-style-type: none"> ◆ EUV Lithography ◆ Thin film deposition, layering technology ◆ High aspect ratio etching ◆ Nano-scale cleaning ◆ Automated technology  <p>FinFET GAA-FET CFET</p>		<ul style="list-style-type: none"> ◆ Advanced 2.xD 3D package ◆ Interposer ◆ Chip stacking technology ◆ Fine redistribution layer (RDL) ◆ Optoelectronic integration technology ◆ Low-K materials  <p>GPU HBM</p>	<ul style="list-style-type: none"> ◆ Inspection for advanced the 2nm process ◆ Chiplet implementation inspection process ◆ Inspection methods for each chiplet implementing process
Quality trend	Issues of advanced process operations, quality evaluation at the wafer level		Quality of the fine implementation process int middle-end process	Yield improvement of advanced devices
	<ul style="list-style-type: none"> ◆ Reliability of chip bonding such as CoW ◆ Methods to check quality in the front-end process 		<ul style="list-style-type: none"> ◆ Finer redistribution layers and TSV connection ◆ Affect of local heat generation of chips ◆ Quality of the fine implementation process int middle-end process 	<ul style="list-style-type: none"> ◆ Process inspection in the front-end process ◆ Process inspection in the middle-end process ◆ Process inspection in the back-end process ◆ Burn-in test for Advanced Semiconductor
Our proposal products	Wafer level semiconductor characteristics evaluation equipment		High-performance, Anaerobic Clean Oven	Package level semiconductor characteristics evaluation equipment
	<ul style="list-style-type: none"> ◆ Semiconductor Parametric (Wafer Level) AMM Series ◆ TDDDB Evaluation System (Wafer Level) AMM Series   <p>https://www.espec.co.jp/english/products/measure-semicon/tddb/</p>		<ul style="list-style-type: none"> ◆ SCO Series ◆ PVHC Series   <p>https://www.espec.co.jp/english/products/env-test/sco/</p>	<ul style="list-style-type: none"> ◆ Semiconductor Parametric test system (Package Level) AMM Series ◆ TDDDB Evaluation System SMU Type (Package Level) AMM Series   <p>https://www.espec.co.jp/english/products/measure-semicon/spa/</p>
Standard	Burn-in test products			
	<ul style="list-style-type: none"> ◆ Static Burn-In System ◆ Dynamic Burn-In System   <p>https://www.espec.co.jp/english/products/measure-semicon/rbs/</p>		<p>This equipment evaluates process defects in the wafer process using parameter testing in combination with a full-auto prober.</p> <p>Mitigate the devices in high temperature environment required for polyimide to imidize (400°C or more) by providing an ultra-low oxygen atmosphere.</p> <p>Uniform insulating layer film can be formed by heat treatment with high temperature distribution performance.</p> <p>This equipment tests semiconductor parameters to verify process issues after packaging.</p> <p>With a temperature chamber, transistor characteristics can be evaluated at the package level in real time under a constant temperature environment.</p> <p>As part of burn-in tests, there is a process to screen defective advanced devices such as SoCs and GPUs. Products being tested are subjected to voltage load or input signals at high temperatures to find and select potentially defective devices before shipping. This equipment integrates the above as an all-in-one testing system with a temperature chamber and has been delivered to many customers.</p>	
CE	—		—	

Reliability test field

Temperature and humidity test, thermal cycle test

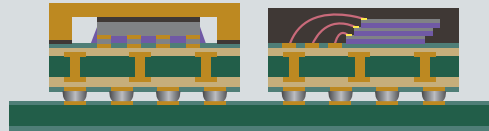
Highly accelerated test, PCT test

Electrochemical migration evaluation of microscopic pattern insulation (HBT/HHBT)

Thermal cycle test Rapid temperature change

- ◆ Complies with testing of leading-edge processes according to the reliability standards
- ◆ Reliable lifespan prediction for microscopic wiring processes
- ◆ Complies with testing of leading-edge 3D packages according to the reliability standards
- ◆ Reliable lifespan prediction for microscopic packaging technologies

FC-BGA

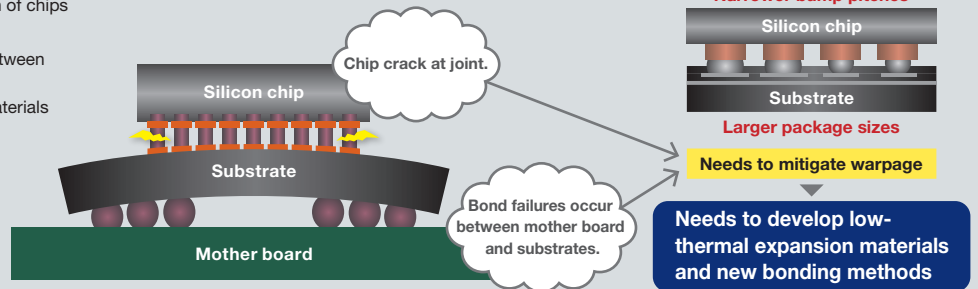


2.xD



Allowable high heat load, microscopic bonding technologies, and technologies to mount more pins

- ◆ Reliability of TSV joints
- ◆ Countermeasures for local heat generation of chips
- ◆ Board heat dissipation design
- ◆ Mitigation of thermal expansion impact between stacked materials
- ◆ Evaluation of multiple types of bonding materials



Temperature and humidity chambers

HAST chamber

Semiconductor measurement systems

Rapid-rate thermal cycle chamber

Recommended system for reliability evaluation testing: Electro-Chemical Migration Evaluation System (AMI Series)

Recommended system for reliability evaluation testing:

- ◆ Platinous Series
- ◆ AR Series

- ◆ EHS Series

- ◆ Electro-Chemical Migration Evaluation System (AMI Series)

- ◆ TCC Series



<https://www.espec.co.jp/english/products/catalog/ar01.pdf>



<https://www.espec.co.jp/english/products/catalog/ehs.pdf>



<https://www.espec.co.jp/english/products/catalog/ami.pdf>



<https://www.espec.co.jp/english/products/catalog/tcc151.pdf>

Our chambers can perform temperature and humidity testing complied to semiconductor reliability test standards. The most suitable model can be selected from the extensive product lineup with various capacities and temperature and humidity ranges.



Platinous J Series
Temperature (& Humidity) Chamber
<https://www.espec.co.jp/english/products/catalog/pj.pdf>

This series of dedicated PCT and HAST chambers accelerate deterioration by pressurizing into the chamber during semiconductor reliability testing.

This insulation evaluation system can instantaneously capture defective insulation phenomena, such as electrochemical migration, in wiring patterns on RDLs and substrates.

The system can work with temperature and humidity chambers and equipped with measurement circuits that allows for high-speed, high-accuracy capture of instantaneous insulation failures such as migration.

This temperature chamber can apply rapid temperature changes to specimens precisely in compliance with JEDEC standard testing and screening.

Suitable for automotive semiconductors, sensors, and electronic devices.

ED-4701/100A, 103A
IEC60068-2-1, IEC60068-2-2

IEC60068-2-66, ED-4701/100A
JESD22-A118B/A110E/A102E, AEC-Q100

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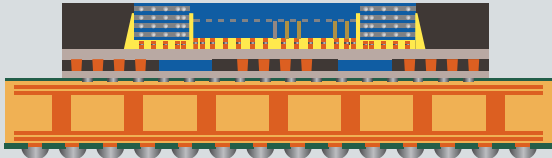
JESD22-A104F, IPC-9701
IEC60068-2-14Nb, IEC60749-25

✓

✓

✓

✓

Thermal shock test	Evaluation of microcracks in wire joints Reliability evaluation of microscopic wiring connections	HALT, HASS	Thermal management
3D			
			
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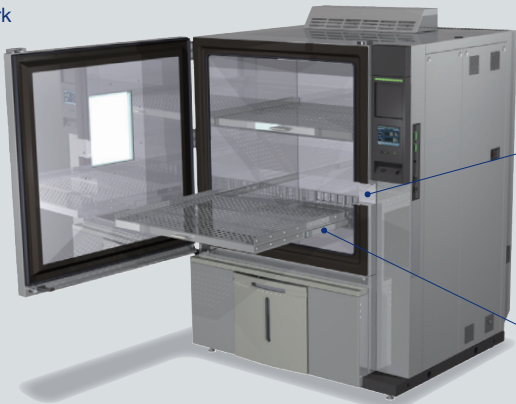
Modification of Environmental Test Chamber for Semiconductor market

Door Notch and Sliding Shelf

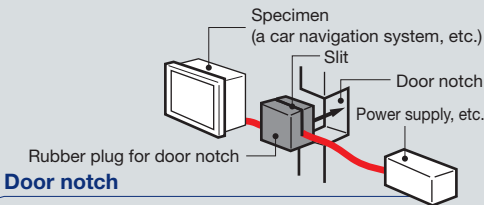
Applicable Series
Platinous J Series and AR Series



- Easy to install heavy objects
- Simple wiring work



<https://espec.satori.site/english/products/catalog/usability#sec2>



Door notch

Dimensions: H100 × D50 mm

* Including dedicated rubber plug



Sliding shelf

Load capacity: Maximum load capacity 100kg

Slide length: Approx. 700 mm

Slide Door

Applicable Series
Bench-Top Type Temperature (& Humidity) Chamber



- Simple wiring work
- Demonstration test provided



Flat cable port type



Sample holder type



<https://espec.satori.site/products/catalog/usability#sec6>
(Japanese only)



Rectangular Cable Port

Applicable Series
Thermal Shock Chamber TSA Series



- Simple large connector wiring work



<https://espec.satori.site/products/catalog/usability#sec4>
(Japanese only)

Dimensions: H125 × D65 mm
Max. number of ports: Maximum 2 on left side wall
Maximum 1 on right side wall



Removable Terminal Blocks

Sliding Panel-Mounted Terminal Blocks

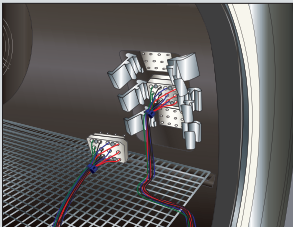
Applicable Series
HAST Chamber



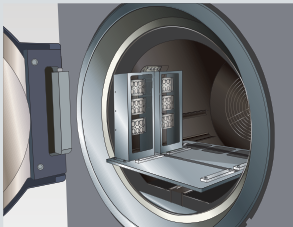
- Simple wiring + simple installation = reduced work time



https://www.espec.co.jp/english/products/book/hast/#target/page_no=13



Terminal block allows 12-pin specimen signal terminals in the test area to be inserted and removed at once



Terminal block that slides to the front

Semiconductor Heat Treatment System

Anaerobic Clean Oven (Oxygen concentration at 10 ppm)

Applicable Equipment
Anaerobic Clean Oven



- Ideal for low oxygen annealing required for 3D semiconductor packaging and integration.
- Enables heat treatment at the lowest oxygen concentration of 10 ppm (0.001%) and Class 5 cleanliness.
- Handles low oxygen, high-temperature annealing from 350 to 500°C. Reduced process time by water cooling.



<https://www.espec.co.jp/english/products/env-test/sco/>



Large-Capacity Types

Large Highly Accelerated Stress Test System—HAST Chamber

Dimensions inside test area
Ø548 mm × L560 mm



<https://www.espec.co.jp/english/products/env-test/ehs431/>



Rapid-Rate Thermal Cycle Chamber

Internal dimensions (mm)
W800 × H500 × D750



<https://www.espec.co.jp/english/products/catalog/tcc301.pdf>



Power Semiconductor-Related Equipment

High Temperature Reverse Bias Test System

Applicable Series
HTRB HTGB H3TRB AMI



<https://www.espec.co.jp/english/products/measure-semicon/bias/>

When the voltage of a power device is shut down, the inductors in the circuit generate surge voltage, which may damage the device. Reverse bias test is repeatedly conducted to improve the reliability of products.

Drain power supply	0 to 2 kV or 0 to 3 kV
Gate power supply	0 to ±30 V or 0 to ±35 V
Temperature control	In-chamber DUT board connection type: 200°C or 350°C

* Temperature/humidity type is also available.

Power Cycle Test System

Applicable Series
RBS-PST



<https://www.espec.co.jp/english/products/measure-semicon/fet-igbt/>

Self-heating cycles due to current on/off of power devices cause wiring disconnection and destruction of heat dissipation circuits. Power cycle tests are conducted to improve product reliability.

Major test modes

Continuous mode	Control the temperature and volume of cooling water to achieve the device temperature setting while "Ice" is constant.
Vf cycle mode	Repeat the control of "Ice" ON/OFF for specimen temperature to achieve the setting temperature.
Cycle mode	Repeat "Ice" ON/OFF by setting the time.

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