



## Reliability Testing for Power Components

SEMTest is the ideal configuration for reliability and extended lifetime testing of Power Semiconductors including IGBT, MOSFET, SCR, Diode and Bipolar parts and modules. This fully integrated solution is intended for product development characterisation and comprises a test system, thermal oven, chiller, cold plates, and test software.

The test system performs a combination of thermal and electrical cycles to verify new products, processes and materials including (SiC) Silicon Carbide based semiconductors or devices designed to meet RoHS requirements.

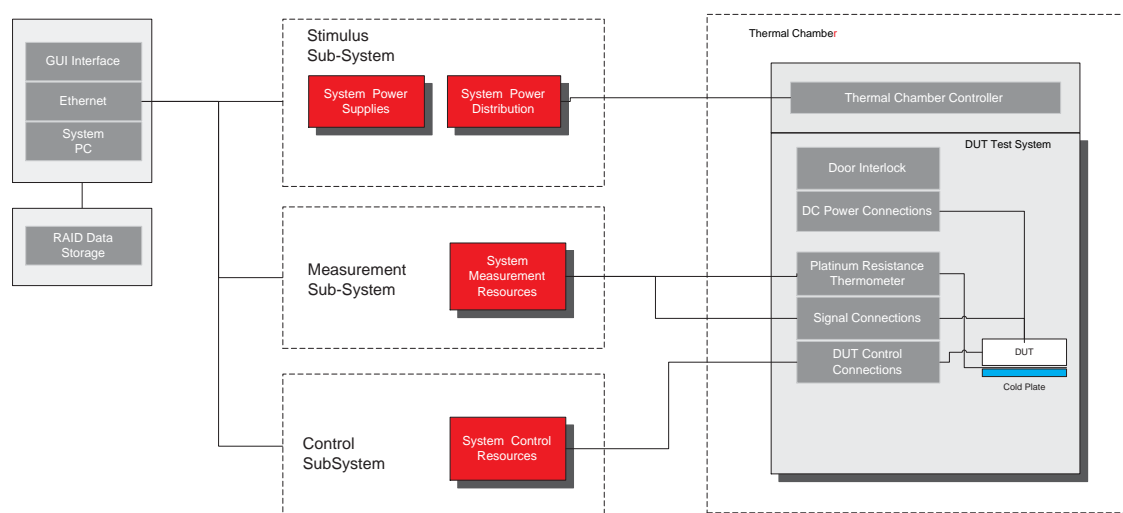
SEMTest is designed to accelerate any failure mechanisms in the device in order to determine its life and functional operating limits.

### Applications

- Design Engineering Verification
- Design Characterisation
- Manufacturing Validation

### Features

- Power Cycles provide thermal and electrical stressing of DUT
- Highly accelerated life testing of DUTs
- Trend Monitoring with user defined warning and control limits
- Junction temperature measurement
- Rapid DUT temperature cycling & ambient temperature profiling
- Detection of nascent failures with automated alert mechanism
- DUT isolated control



### Tests and Measurements

- Voltage up to 1200V
- Current up to 1000A
- Power up to 20kW (total dissipated power)
- DUT Voltages
- Temperature range -40°C to +180°C
- Switching frequency to 20kHz
- Duty cycle from 10% to 90%
- Multiple DUTs, up to 100 or more

Intepro's broad knowledge and long experience in power device testing ensures high quality comprehensive test coverage which can be tailored to meet your specific test requirements. Intepro's team of experts consult with the customer every step of the way from project specification to design, build and integration. Intepro's expertise in high end power electronics has been the cornerstone of our worldwide success since starting out 26 years ago.



Modular system for easy expansion

## Test System Overview

The SEMTest ATE System can test up to 1000 DUTs at the same time. The focus of the test is to simulate harsh electrical and environmental conditions demanded of the automotive, railway, aerospace and defense industries.

Each channel can control the DUTs in linear, switched, saturated, voltage breakdown and avalanche modes.

### Measurements

The following DUT parameters can be measured on each channel: DIE temperature, DUT terminal voltage, DUT current, DUT power ambient temperature, elapsed test cycles and test times.

### Realtime Monitoring

DUT failures are detected by real time DUT monitoring circuitry, which compares measured values to warning and control limits based on DUT history. When a DUT starts to fail, all electrical stresses are removed within 30msec. This prevents further catastrophic damage to the DUT and allows the user to remove it for detailed failure mode analysis.

Built around a modular architecture the SEMTest configuration can be modified to meet specific customer requirements.

### Benefits

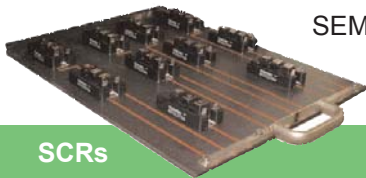
- Predefined solution tailored to customer specification
- Full control of DUT test parameters is provided
- SQL compatible test executive software with Ethernet communications
- Realtime monitoring measuring against control limits
- Programmable software with automated test & reporting
- Highly modular and flexible for future expansion
- Body and case temperature control options
- DUT shutdown feature for failure mechanism analysis
- Steady state and switch mode operation from DC to 20kHz
- Automated turnkey system brings significant savings to engineering time and resources

### System Configuration

Each channel consists of a local controller, and interface card and power switch. Overall systems control and data archiving is provided by a central PC. Communications between the PC and the individual controllers is provided over an Ethernet based LAN.

SEMTest's configurability and modularity supports a wide range of test devices with high power levels built in from the start. This flexibility also allows for future expansion and upgrades.

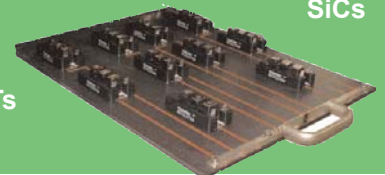
SCRs



Diodes



MOSFETs



SiCs

### Operation modes include:

- Linear
- Switched
- Saturated
- Voltage Breakdown
- Avalanche

### Typical DUT parameters measured

- DIE temperature
- DUT terminal voltage
- DUT current & power
- Ambient power & temperature
- Elapsed test times & test cycles

# Climatic and thermostatic chambers

## Thermal Chamber

The environmental chamber uses a silicone oil based coolant to control the temperature of both its own internal ambient and that of heat removing cold plates to which the DUTs are fixed. The chamber has a typical cooling capacity of 15kW and controls the ambient temperature and cold plate temperatures.

DUTs are mounted onto the coldplates in the thermal chamber via sliding trays and the thermal chamber is set and regulated between -40°C to +180°C via Intepro's front end test executive software.



Cold Plate on sliding tray



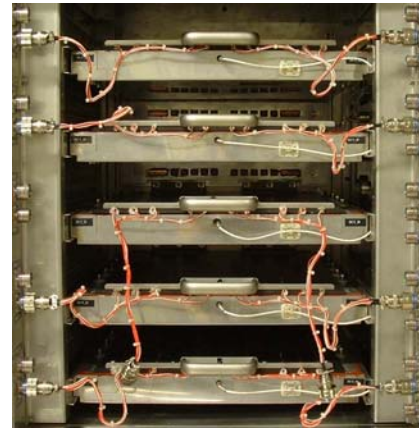
Thermal Chamber

### DUT Cold plates

With 15kW of cooling capacity the cold plate temperature can range from -35°C to +170°C

### Electrical stimulus

Platinum Resistance Thermometers (PRTs) are electrically connected to the DUTs through the rear of the chamber.



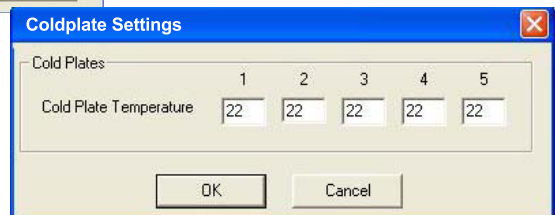
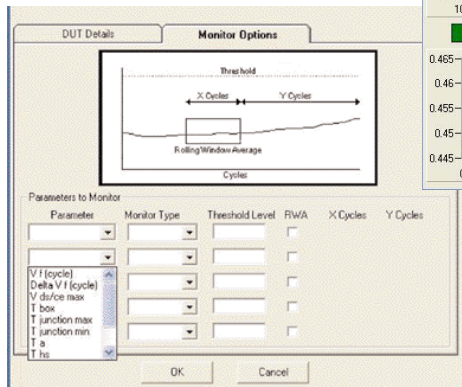
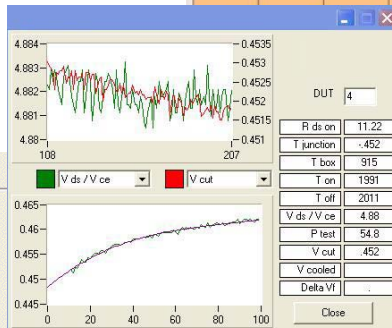
Multiple coldplates in chamber

## Software

System test configuration is programmed at the PC using a user friendly GUI (Graphical User Interface).

Local control of the test is performed by distributed local controllers. A DUT interface card is used to provide high power isolated control for particular DUT types.

Test results are written to an SQL Database.



## Operation and Measurement Performance

### DUT Test Conditions

Current	Up to 1000A
Voltage	Up to 1200V
Power Dissipation	Up to 20kW

### Operation Modes

Linear	Current controlled by gate voltage
Enhanced	Gate connected to drain or collector
Switched	Frequency up to 20kHz - UIL (unclamped inductive load)
Saturated	Varying terminal voltage
Voltage Bias	Voltage stress applied to DUT in OFF condition - HRTB (high temperature reverse bias)
User Defined Thermal Cycles	1sec to 3600sec on any combination of the above modes (typical)

### System Hardware

Test Channels	Up to 1000 DUTs or greater
MSC	Modular system controller
IVT module	DUT interface card
PSU	System power
PSU Switches	Isolation of DUT and system power
Thermal Units	Thermal Chamber and Chiller
Special Configurations	Systems can be configured for: P type semiconductors N type semiconductors SiC (Silicon Carbide) base semiconductors
Data Storage Option	PC with optional RAID data storage

### Safety

EN61010

## Temperature

### Environmental

Thermal Chamber	Ambient temperature range -40°C to +180°C (typical)
Cold Plates	Temperature cycle range -35°C to +170°C (typical)

### DUT

DUT Junction Temperature	Measurement to $\pm 2^{\circ}\text{C}$
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## Additional Information

### Interfaces

Ethernet

Programmable to remove electrical stresses upon identification of indicated DUT failure

### DUTs

Diodes, Semiconductors, IGBTs, SiCs, MOSFETs, SCRs, Bi-Polar modules

### CE Quality Mark

# **INTEPRO** SYSTEMS



## **Intepro Systems**

Intepro has had 25 years of experience completing high end power electronic projects to stringent budget and time requirements. Flexible system architecture and a dedicated engineering team provide technical support from initial system specification design, right through to build, test, installation, application and lifetime maintenance.

Key to this is the assigning of a dedicated project manager to work closely with our customers throughout the entire process. Intepro Systems has built its reputation in the high complexity test market by establishing long-term relationships with key clients.

## **Intepro Systems**

*The Power Test Experts*

### **Intepro Systems Contacts**

Intepro Systems Lonsdale Rd, National Technology Park, Limerick Ireland  
T+353 61 332233 F+353 61 332584 Derek.Somers@inteproate.com

Intepro Systems Ashville Way, Molly Millar's Lane, Wokingham Berkshire RG41 2PL / UK  
T+44 118 9770070 F+44 118 9792969 colin.sycamore@inteproate.com

Intepro Systems 1530 S. Lyon Street, Santa Ana, Ca 92705  
T+1 714 679 9749 F+1 714 835 3441 joe.engler@inteproate.com

**[www.inteproate.com](http://www.inteproate.com)**