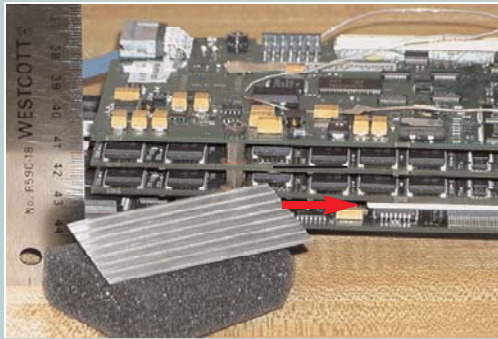


Innovation in Thermal Management™

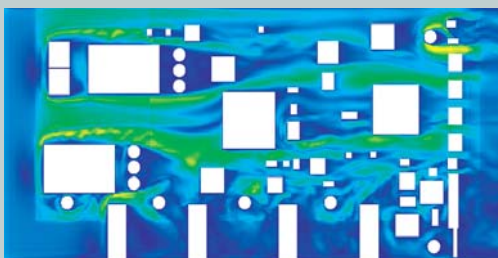
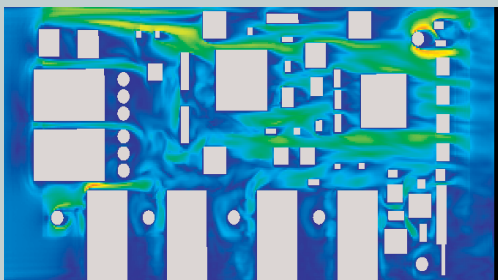
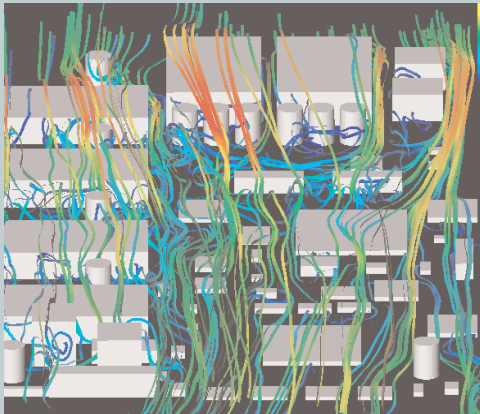


THERMAL CONSULTING SERVICES

Custom solutions for tough to cool applications



PCB Optimization layout using CFD (Direct Numerical Simulation)



SERVICES

ATS offers solutions/capabilities in the following select areas:

- Assessing and designing the cooling solution- from air cooling to high capacity liquid cooling
- Thermal design in all facets of packaging
- Thermal characterization of ICs, heat sinks and boards
- Thermal management of components
- Packaging alternatives for ICs
- Alternative PCB packaging, thermal and EMI shielding
- Fan selection and performance management
- Fan tray design and its system placement
- Acoustic noise management
- Air flow management at board and system levels
- Thermal management of telecom racks or bays
- Custom heat sink design and alternate solutions
- Product testing requirements per national and international standards (e.g., NEBS and JEDEC)
- Reliability evaluations
- Design of liquid cooled or high-capacity cooling systems
- Compliance testing per industry standards through partnership with two outside laboratories.

PROCESS

ATS will conduct a detailed thermal analysis and experimentation of the entire packaging domain, including components, printed circuit boards (PCBs) and the complete system.

COMPUTATIONAL FACILITY

ATS offers a computational facility with the latest thermal software tools. These include Flotherm™, TAS-PCB™, ANSYS™, CFDDesign™, and macroFLOW™.

THERMAL/FLUIDS LABORATORIES

ATS has three research laboratories dedicated to thermal testing and R&D. These labs, located in the US and Holland, are some of the most equipped thermal labs in the industry that include facilities for air and liquid cooling. In addition, ATS offers two chambers for elevated temperature testing and system evaluation.

LAB CAPABILITIES

- **Flow Simulation** in high and low speed wind tunnels for component, heat sink and PCB level characterization at different operating ambients.
- **Thermography (Die Level)** Liquid Crystal Imaging system for temperature measurement and mapping of ICs and components. The measurement resolutions span from small scale(1 micron) to large PCBs.
- **Thermography (PCB and System)** IR thermography system for component, board and system thermal mapping.
- **Velocity Measurement** with hot wire anemometry for mapping velocity and temperature distributions in PCBs and systems.
- **Contact Resistance** measurement capability.
- **Thermal Conductivity** measurement facility.
- **Heat Transfer Coefficient** measurement facility.
- **Liquid Cooling Facility** for thermal characterization of heat sinks and boards; 3KW cooling capacity.
- **Elevated Temperature Testing Facility** for components and boards.
- **Sensor Calibration Services** for temperature, velocity, pressure and heat flux sensors.
- **Fan Characterization Facility** for pressure drop versus volumetric flow rate measurements. For single fans (all sizes) and fan trays.
- **Water Tunnel** for PCB thermal optimization and component layout enhancement.

PRODUCTS OVERVIEW

HEAT SINKS

High- and Ultra-Performance™ heat sinks for passive and active cooling of ICs and power electronics. As the table below indicates, superior ATS design/manufacturing leads to higher performance for the same volume.

HEAT SINK PARAMETER	ATS	COMMERCIALY AVAILABLE
Base	45mm x 45mm	45mm x 45mm
Height	15mm	15mm
Fin Thickness	0.2mm	0.5mm
Fin to Fin Spacing	2.5mm	2.0mm
Thermal Resistance R _{sa} (°C/W)*	1.6	2.54
Percentage of Improvement	56.2%	**

**R_{sa}, Sink-to-ambient thermal resistance is measured at 1 m/s (200ft/min)

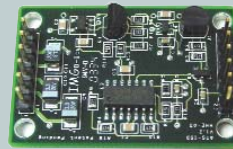
*Sample information for ATS passive heat sink only compared to a similar commercially available heat sink.

WIND TUNNELS

High and low velocity wind tunnels for component and board-level testing. Open- and closed-loop wind tunnels are available. Their compact size allows for vertical or horizontal placement.

CONTROLLERS

ATS designs and manufactures control systems for test automation. These systems, such as WTC-100™ or PCS-1000™, provide a high-degree of automation and control over air velocity and air temperature in a wind tunnel or card rack.



ISD BOARDS

ATS designs and manufactures PCB-based devices that measure air velocity and air temperature using two sensors. These devices are designed with analog or digital signal output, and are used as stand alone units or utilized in independent applications.

LIQUID CRYSTAL IMAGING SYSTEM

thermVIEW™ is the liquid crystal imaging system designed for board, components and chip thermal imaging. This system has a temperature range of -10°C to 160°C with a spatial resolution of 1 micron.

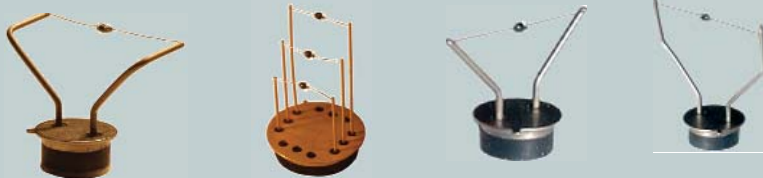
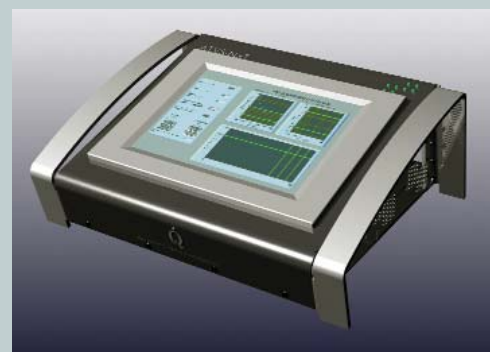
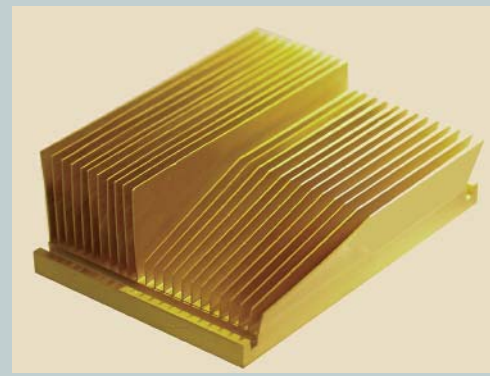
FAN TRAYS AND CONTROLLERS

ATS designs and manufactures fan trays and controllers for a variety of applications including telecommunication and laser equipment industries.

FLOW MEASUREMENT- HOT WIRE ANEMOMETRY SYSTEMS

ATS designs and manufactures a family of portable, multi-channel hot wire anemometry systems. All systems utilize ATS patented single-sensor technology for simultaneous measurement of temperature and air velocity, resulting in precise measurement. The same sensors measure air velocity for the full spectrum - from 0 to 51 m/s (10,000 fpm)

Please visit www.qats.com for additional products, accessories and new releases.





WHO WE ARE

HISTORY

ATS was founded in 1989 and has migrated from a consulting company to a complete solutions provider. In the interval of three years, ATS has established its own manufacturing center in the US, developed strategic partnerships with Asian manufacturers and opened ATS-Europe, its office in Holland. As ATS has significantly increased its customer base, its product offerings have also expanded to include Advanced Fan Trays, Liquid Cooling Systems, Advanced Cooling Solutions and Next Generation Thermal Test Instruments.

WHY CHOOSE ATS?

TECHNICAL EXPERTISE

ATS engineers have over 100 years of collective thermal management experience, 35 patents, over 70 professional publications, and receive continual requests for technical presentations at international and national conferences.

LEADING EDGE R&D

Highly trained ATS engineers are pushing the frontiers in thermal packaging solutions - from components to circuit boards to racks to entire systems. Innovation and commitment to R&D are the cornerstones of ATS' success in the thermal management market.

HIGH- AND ULTRA-PERFORMANCE™ HEAT SINKS

From its portfolio of more than 450 high performance heat sink designs, ATS is unique in offering lightweight, custom heat sinks designed to cool today's electronics.

OFF-THE-SHELF & CUSTOM EXTRUSIONS

ATS offers a line of high performance extrusion heat sinks that are suitable for a family of component package types. These heat sinks are offered in 2 to 25mm heights. In addition, ATS offers any off-the-shelf extrusions at competitive pricing through its Asian partners.

STATE-OF-THE-ART-THERMAL TEST AND MEASUREMENT EQUIPMENT

ATS offers state-of-the-art, research-quality thermal test and measurement equipment with customized software and unequalled accuracy. ATS thermal test equipment are uniquely suited for measurement in electronics enclosures.

MANUFACTURING CAPABILITIES

From its state-of-the-art US-based rapid prototyping and production facility to its multiple strategic partners positioned in Europe and Asia, ATS has the capability to meet virtually any metal fabrication requirements with dual sourcing options and ISO certified partners.

PRODUCT QUALITY

ATS is committed to offering high quality, reliable products and services that meet specified requirements and customer expectations. ATS and its ISO certified partners around the globe collaborate to ensure consistent high-quality manufacturing and delivery of all ATS products.

EXCEPTIONAL CUSTOMER SERVICE

ATS is committed to providing exceptional customer service through effective communication and problem resolution, thus ensuring timely delivery of quality products and services. At ATS, building long-term customer relationships is our highest priority.

Advanced Thermal Solutions, Inc.

89-27 Access Road, Norwood, MA 02062 USA

Tel: 781-769-2800 / Fax: 781-769-9979

Email: ats@qats.com / Web: www.qats.com