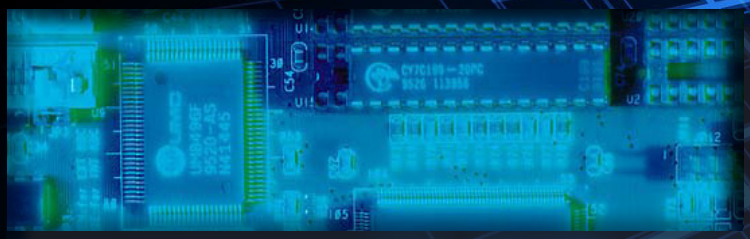
ATS ADVANCED THERMAL SOLUTIONS, INC.
Innovations in Thermal Management®

INNOVATIONS IN THERMAL MANAGEMENT



CREATE

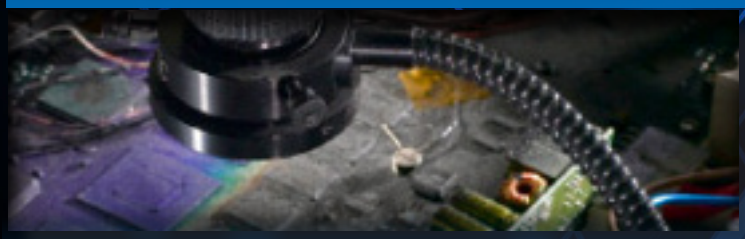
DESIGN SERVICES AND RAPID PROTOTYPING

Through its computational facilities and thermal/fluids laboratories, ATS specializes in providing thermal analysis, mechanical and design services for telecommunications, networking, medical equipment, military defense, embedded computing and other market sectors with high performance electronic products. From concept to production, our customers get their products to market faster with our rapid prototyping and manufacturing services.

COOL

LIQUID AND AIR COOLING SOLUTIONS

ATS is world renowned for its advanced air and liquid cooling solutions with over 5000 high-and ultra-performance heat sinks. ATS' extensive portfolio of high performance cooling solutions is ideally situation to address the most demanding thermal challenges on the market. Additionally, ATS offers an extensive array of standard, off-the-shelf cooling solutions to meet all your thermal management requirements.



TEST

INSTRUMENTATION

ATS designs and fabricates the most extensive line of thermal test instruments specifically designed for the electronics industry. These research-quality, state-of-the-art instruments include Pressure, Temperature and Velocity Measurement Systems, Airflow and Heat Flux Controllers, Open- and Closed-Looped Wind Tunnels, Micron-level Thermography Systems and Cold-Plate Thermal Characterization Systems.

LEARN

TRAINING

As an industry leader, ATS values the importance of further developing the electronics cooling industry and offers short courses, tutorial programs, and free monthly webinars. In addition, ATS publishes **Qpedia Thermal eMagazine,** a free monthly technical publication with a circulation of over 18,000 engineers worldwide. Qpedia is also the media sponsor of the internationally recognized coolingZONE Summit.

Design Services

THE TRUE COMPLETE SOLUTIONS PROVIDER

Advanced Thermal Solutions, Inc. offers comprehensive thermal management analysis and design services for telecommunications, networking, medical equipment, military defense, embedded computing and other high performance electronic products. Our clients get their products to market faster, safer, and at a lower cost.

Thermal Design & Analysis

ATS' thermal management analysis and design services encompass both experimental and computational simulations using proprietary tools and computation fluid dynamics software packages such as FLOTHERM and CFdesign. ATS studies the full packaging domain, including components, circuit boards (PCBs), shelves, chassis, and system packaging. The company's design services include heat sink, board and fan characterization; heat sink and fan tray design and optimization; liquid cooling design; prototyping of heat sinks and complete cooling systems; and wind tunnel testing of components, PCBs, chassis and enclosures.

Prototyping Services

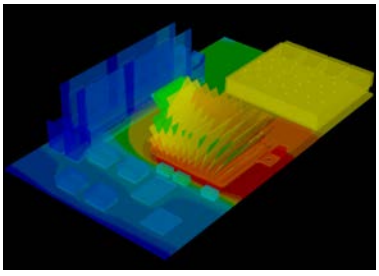
ATS offers rapid prototyping of machined parts and cooling systems from its US facilities. Sheet metal fabrication and cut heat sink prototypes are quickly provided from our Chinese partners.

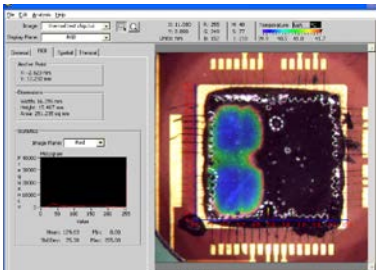
Customized Solutions

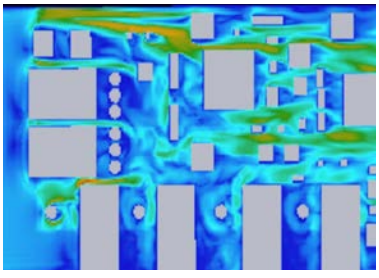
We believe customers who wish to remain competitive should consider a design-to-suit opportunity solution first. Contrary to common perception, this proves to be less expensive to the customer in the long run, because of the ensuing gain in product efficiency and compatibility.

The ATS Difference

Working side-by-side with customers worldwide, ATS design teams provide tailored solutions to thermal and mechanical packaging challenges on real projects with real schedules. Our goal is to deliver the right solution the first time, on time, every time.







» **Flow Simulation**
High and low speed wind tunnels for component, heat sink and PCB level characterization at different operating ambient

» **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 board and system thermal mapping

» **Velocity Measurement**
Hot wire anemometry for mapping velocity and temperature distributions in PCBs and systems

» **Thermal Conductivity**
Material thermal conductivity measurement facility

» **Heat Transfer Coefficent**
Measurement facility

» **Liquid Cooling Facility**
For thermal characterization of heat sinks and boards, 3kW cooling capacity

» **Water Tunnel**
Flow visualization of heat sink, component and PCBs

» **Elevated Temperature**
Testing facility for components and boards

» **Sensor Calibration Services**
For temperature, velocity, pressure and heat flux sensors

» **Fan Characterization Facility**
Pressure drop versus volumetric flow rate measurement

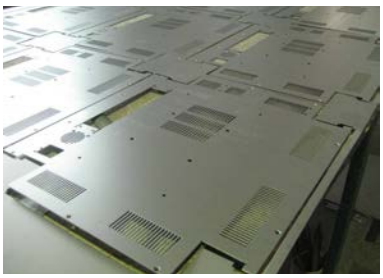
For more information, call 781.769.2800, email ats-hq@qats.com. or visit qats.com

Manufacturing Services

RAPID PROTOTYPING AND HIGH VOLUME MANUFACTURING

With its world class manufacturing and design centers located in the U.S. and China, ATS is positioned to support a wide variety of contract fabrication services, including aluminum extrusion, precision machining, metal forming, welding and other fabrication for diverse industries across the globe.

At our global headquarters in Massachusetts, ATS utilizes the latest design and fabrication tools with a staff of over 15 engineers to provide innovative design services with rapid prototyping and low-moderate production volumes to meet initial product requirements. High volume production is supported by our ShenZhen facilities to reduce cost and lead times, giving our customers a competitive advantage. Through extensive U.S. based process controls, ATS ensures product conformity to mechanical drawing specifications throughout the design and manufacturing cycle from initial prototype to 1M+ volumes.



Norwood, MA Rapid Prototyping Center & Low Volume Production

Equiment / Services:
4 Precision CNC vertical milling machines
1 High volume CNC horizontal mill with dual rotary pallets
5 Manual vertical & horizontal mills
2 Vertical & horizontal bandsaws
5 Saws & shears
5 Arbor punch presses
15 sanders, grinders & tumblers
metal welding - MIG, TIG & spot welding
plastic welding, bending & forming

Design Centers:
MA, USA and Bussum, Netherlands

Factory Locations:
MA, USA and ShenZhen, China

Warehouse/Distribution Centers:
MA, USA and Futian, China

Certifications:
ISO9001:2008, UL, Hong Kong Safety, KEMA

Volume Capacity:
MA, USA – 30K/mo and ShenZhen, China - Unlimited

For more information, call 781.769.2800, email ats-hq@qats.com. or visit qats.com

» Global Leader in Design & Fabrication
Worldwide design, fabrication and distribution services in state-of-the facilities to meet virtually any metal fabrication requirement

» Integrated ERP/MRP System & Customer Portal
Provides effective production planning and customer visibility to order status.

» Certifications
All facilities ISO 9001:2008 certified

» Materials
Aluminum alloys (AL6061/6063)
Copper
Plastics
Stainless steel
RoHS compliant

» Surface Finish
Anodization
Plating
Powder coating
Silk screen print

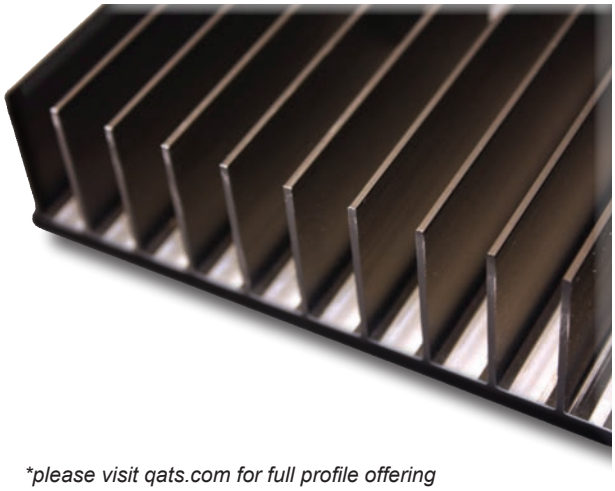
» Fabrication Methods
Bending/ cutting
Die cast
Extrusion
Punch press
Progressive die
Sheet metal fabrication
Plastic welding & bending
Metal welding - MIG, TIG, & spot welding
Precision CNC machining

» In-Stock Extrusion Profiles
Wide variety of in-stock aluminum extrusions in straight-fin, cross-cut and maxiFLOW™ fin geometries to meet specific customer requirements

» No min. order requirements

Extrusion Profiles

RAPID PROTOTYPING AND MANUFACTURING FOR CUSTOM COOLING SOLUTIONS



Aluminum extrusions are the most cost-effective solutions for the majority of electronic cooling applications. ATS offers a wide variety of aluminum profiles used for heat sink fabrication and other aluminum applications. Whether you are seeking a standard extrusion profile or the expertise from our design team to create a totally new and innovative profile, ATS has the capabilities and expertise to meet your requirements.

Extensive Capabilities

From its facilities in Norwood, MA and strategic partnerships throughout Southern China, ATS offers:

- Over 100 in-stock, high-performance straight fin and maxiFLOW™ extrusion profiles
- Custom profiles available upon request to meet your specific requirements
- An extensive inventory of profiles in a wide variety of sizes, ranging from 41 - 483mm (1.61in - 19.01in) in width and 10 - 73mm (0.39in - 2.87in) in height
- Standard bar lengths of 6, 12 and 18” for ease of manufacturing design prototypes
- High performance extrusions with thermal resistance characteristics as low as 1.120C
- RoHS compliant, aluminum alloy 6061/6063
- No minimum order quantity (MOQ) permitting you to order the exact quantity you require from prototype builds to high-volume production
- All extrusion profiles unfinished (degreased) with custom finishes (anodization) available upon request to meet application-specific requirements
- **A wide variety of secondary metal fabrication services through ATS Manufacturing including precision cutting, milling, punching, drilling and notching to meet all your design requirements**

For more information, call 781.769.2800, email ats-hq@qats.com. or visit qats.com

*please visit qats.com for full profile offering

MPN	L	W	H	# of Fins
ATS470041033-EXL17-R0	470	41	32.8	6
ATS470052019-EXL28-R0	470	52	19.1	9
ATS470073033-EXL23-R0	470	73	33.3	10
ATS470073025-EXL32-R0	470	73	25.4	24
ATS470076057-EXL25-R0	470	76	57.2	8
ATS470076038-EXL27-R0	470	76	38.1	8
ATS-312-EXL-R0	1524	80	30.0	32
ATS470089022-EXL20-R0	470	89	21.6	12
ATS406100010-EXL-1	406	100	10.0	40
ATS406100020-EXL-2	406	100	20.0	40
ATS406100027-EXL-6	500	101	27.0	40
ATS406101014-EXL-7-R1	406	101	14.5	42
ATS470101033-EXL16-R0	470	105	33.3	14
ATS470105044-EXL10-R0	470	105	44.5	10
ATS470108026-EXL33-R0	470	108	26.0	26
ATS470111033-EXL13-R0	470	111	32.8	14
ATS-470114036-EXL15-R0	470	114	35.6	12
ATS470127032-EXL18-R0	470	127	32.0	12
ATS470154044-EXL11-R0	470	154	44.5	13
ATS470154057-EXL31-R0	470	154	57.2	15
ATS470164033-EXL12-R0	470	164	33.3	21
ATS470171041-EXL21-R0	470	171	41.4	16
ATS470186022-EXL19-R0	470	186	22.2	24
ATS470186033-EXL29-R0	432	186	33.3	24
ATS-424-EXL-R1	432	188	16.5	35
ATS470200033-EXL26-R0	470	200	33.3	27
ATS470212051-EXL14-R0	470	212	50.8	12
ATS470251033-EXL34-R0	470	251	33.0	30
ATS470310073-EXL30-R0	470	310	73.3	18
ATS470432033-EXL24-R0	470	432	33.3	55
ATS470483033-EXL22-R0	470	483	33.3	61

ATS ADVANCED THERMAL SOLUTIONS, INC.
Innovations in Thermal Management®

INNOVATIONS IN THERMAL MANAGEMENT

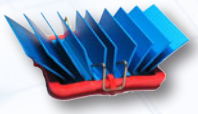
Heat Sink Overview

maxiFLOW™

L: 15-45 mm
W: 15-45 mm
H: 7.5-19.5 mm

maxiFLOW™ design features a low profile, spread fin array that maximizes surface area for more effective air cooling.

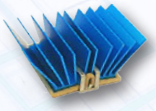
maxiFLOW™ maxiGRIP™



L: 17-45 mm
W: 17-45 mm
H: 7.5-19.5 mm

maxiGRIP™ is a secure heat sink attachment that does not require holes in the PCB. For STD and low profile component heights 1.5-4.5 mm

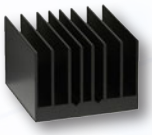
maxiFLOW™ superGRIP™



L: 15-45 mm
W: 15-45 mm
H: 7.5-19.5 mm

superGRIP™ strong, uniform attachment force helps achieve maximum performance. Requires minimal space around components perimeter making it ideal for densely populated PCBs.

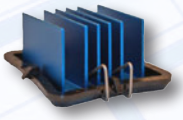
Straight Fin



L: 15-45 mm
W: 15-45 mm
H: 7.5-24.5 mm

High aspect ratio straight fin extrusions with the best thermal performance in its class.

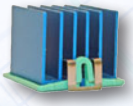
Straight Fin maxiGRIP™



L: 17-45 mm
W: 17-45 mm
H: 7.5-19.5 mm

maxiGRIP™ is a secure heat sink attachment that does not require holes in the PCB. For STD and low profile component heights 1.5-4.5 mm

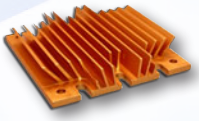
Straight Fin superGRIP™



L: 15-45 mm
W: 15-45 mm
H: 7.5-19.5 mm

superGRIP™ strong, uniform attachment force helps achieve maximum performance. Requires minimal space around components perimeter making it ideal for densely populated PCBs.

maxiFLOW™ Brick



L: 23-117 mm
W: 23-118 mm
H: 6-23 mm

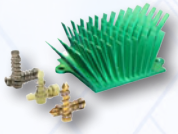
maxiFLOW™ heat sinks, specially designed to cool 1/8, 1/4, 1/2 and full brick DC-DC power converters.

fanSINK™

L: 27-45 mm
W: 27-45 mm
H: 9.5-24.5 mm
*fan not included

Cross-Cut heat sink with maxiGRIP™ attachment allows for the direct attachment of the fanSINK™ to the component.

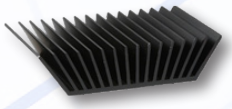
Push Pin



L: 40-41 mm
W: 38-45 mm
H: 10-25 mm

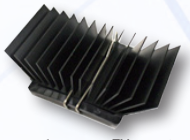
maxiFLOW™ push pin heat sinks based on industry standard hole patterns for a variety of device cooling applications.

ASIC Cooling



Designed specifically for ASIC packages and their unique cooling requirements.

Flip-Chip Cooling



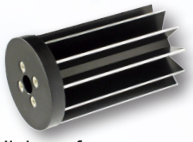
L: 21-62 mm
W: 32-52 mm
H: 9-16 mm

maxiFLOW™ custom designs for flip-chip components such as Freescale MPCs.

LGA Cooling

High performance cooling solutions for high power LGA components.

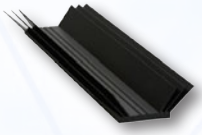
STAR LED



L: 18-85 mm
Dia: 45-100 mm

High-performance cooling solutions designed for high heat flux LEDs.

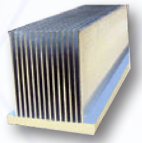
Linear LED



L: 305-330 mm
W: 45 mm
H: 26 mm

maxiFLOW™ design for cooling linear LED lighting products. Reduces temperatures by 50%

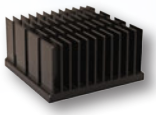
Extrusions



L: 140-1524 mm
W: 41-483 mm
H: 10-73 mm

High performance aluminum extrusions provide cost-effective price points in over 120 profiles.

High Performance Extrusions



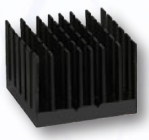
L: 10-60 mm
W: 10-60 mm
H: 2-25 mm

Over 1300 high performance specialty extrusions offered in 3 fin type configurations: straight fin, slant fin, and cross-cut.

Stamped

Diverse range of board level applications. Over 74 different designs for varied applications.

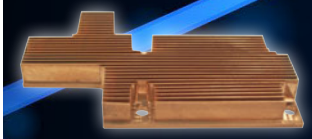
Cross-Cut



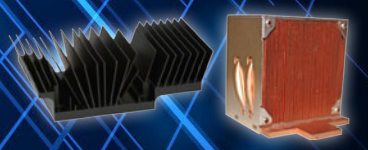
L: 15-45 mm
W: 15-45 mm
H: 7.5-24.5 mm

High aspect ratio cross-cut extrusions with the best thermal performance in its class.

Custom Designed Air and Liquid Cooling Solutions



ATS is world renowned for its custom designed solutions of over 5000 high- and ultra-performance heat sinks. From concept to production, ATS is positioned to meet all of your application-specific cooling and packaging requirements.

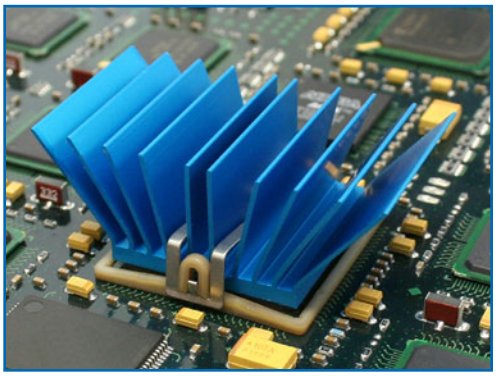


ADVANCED THERMAL SOLUTIONS, INC. | 89-27 ACCESS ROAD | NORWOOD, MA 02062 USA | T: 781.769. 2800 | ATS-HQ@QATS.COM | WWW.QATS.COM

superGRIP™

HEAT SINK ATTACHMENT FOR DENSELY POPULATED PCBS

- Provides tight, secure heat sink attachment in shock and vibration environments
- Occupies minimal area around chip, allowing its use in densely populated PCBs
- Allows the heat sink to be detached and reattached without damaging the component or the PCB
- Strong, uniform attachment force helps achieve maximum performance from phase-changing TIMs

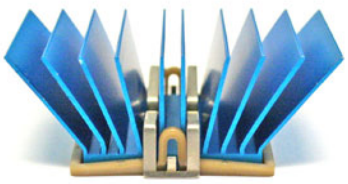


ATS' patented superGRIP™ Heat Sink Attachment System

About superGRIP™

ATS' superGRIP™ is a new two-component, attachment system which quickly and securely mounts heat sinks to a wide range of hot running Ball Grid Array (BGA) components, while using a minimal amount of space on the PCB and eliminating the need to drill holes.

The two-part superGRIP™ system features a plastic frame clip that fastens securely around the perimeter of a component and a metal spring clip which slips through the heat sink's fin field and locks securely to both ends to the plastic frame. The resulting superGRIP™ assembly applies steady, even pressure to the component throughout the product lifecycle, improving thermal performance and long-term reliability.



With this latest edition, ATS now offers two tiers of heat sink clip attachment: maxiGRIP™, for general purpose and high performance applications: and superGRIP™, for high performance applications with densely populated PCBs and little space around the component for mechanical attachment.

ATS' superGRIP™ heat sink attachment system permits the use of high performance phase changing thermal interface materials that improve heat transfer by as much as 20 times more than typical double-sided adhesive thermal tapes. It also allows for the heat sink to be detached and reattached without damaging the component or the PCB, an important feature for applications where PCB rework and ease of assembly and disassembly are important.

The superGRIP™ system is available with ATS' maxiFLOW™ family of heat sinks which feature a low profile, spread fin architecture to maximize surface area for more effective convection (air) cooling. Testing at an air flow rate of just 0.5 m/s (100 ft/m) shows that device junction temperatures (Tj) can be reduced by more than 20 percent below the temperatures achieved using heat sinks with traditional fin styles.

It is also available with ATS' straight fin and cross cut heat sinks, as well as additional sizes and configurations, as custom options.

For further technical information, please contact Advanced Thermal Solutions, Inc. at 1-781-769-2800 or www.qats.com

superGRIP™ FEATURES:

» Minimal Keep Out Area
Requires minimal space around the component's perimeter; ideal for densely populated PCBs

» Improves Performance
superGRIP's strong, uniform attachment force helps achieve maximum performance from phase changing thermal interface materials

» Easy Installation and Removal
Allows heat sink to detached and reattached without damaging the PCB.

» Thermal Interface Material
Comes standard with clean-break, reworkable, Chomerics T-766 phase change material

» Frame Clip
Made from plastic resins that allow it to be thin, yet incredibly strong

» Spring Clip
Flat, twin-channel clip, made from 300 series stainless steel, provides strong retention forces

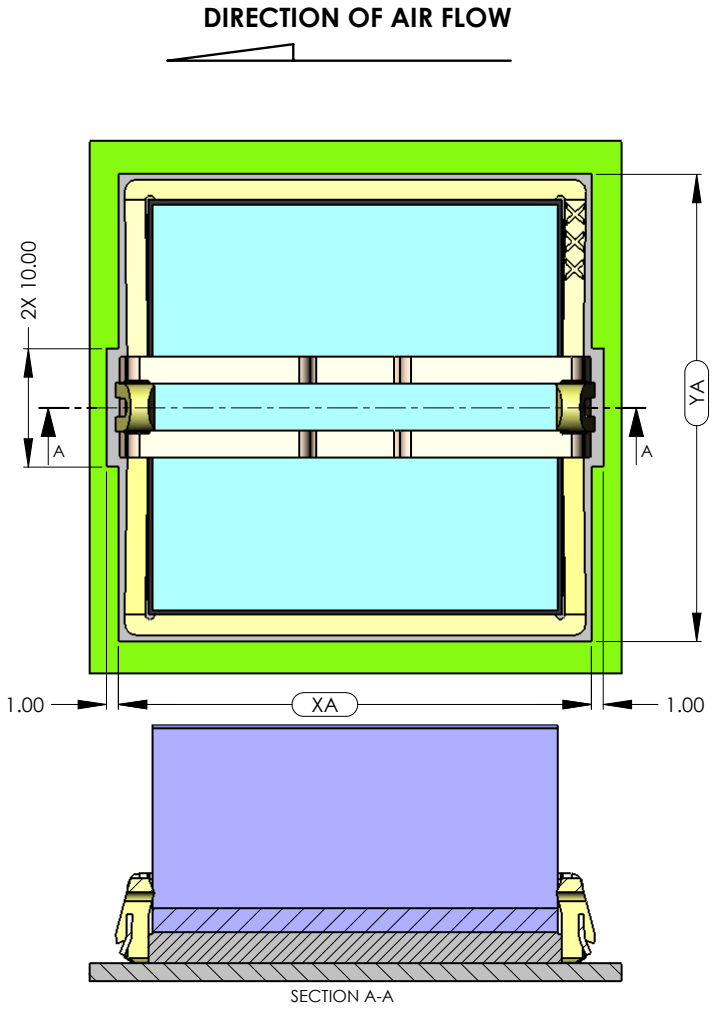
» No Special Tools Needed
Frame and spring clips can both be installed by hand or with common hand tools such as a flat blade screwdriver

» maxiFLOW™ Heat Sink
Available with maxiFLOW™ heat sinks which maximize surface area for more effective convection (air) cooling

» Custom Options
Clips and heat sink can be customized in different sizes

superGRIP™ Clearance Guidelines

Required Board Keep Out Region for superGRIP Heat Sink Attachment Hardware



NOM SIZE (mm)	XA (mm)	YA (mm)
15 x 15	18.5	18
17 x 17	20.6	20.1
19 x 19	22.7	22.2
21 x 21	24.9	24.4
23 x 23	27.1	26.6
25 x 25	29.3	28.8
27 x 27	31.5	31
29 x 29	33.6	33.1
30 x 30	34.7	34.2
31 x 31	35.8	35.3
32.5 x 32.5	37.4	36.9
33 x 33	37.9	37.4
35 x 35	40	39.5
37.5 x 37.5	42.7	42.2
40 x 40	45.4	44.9
42.5 x 42.5	48	47.5
45 x 45	50.7	50.2

NOTES:

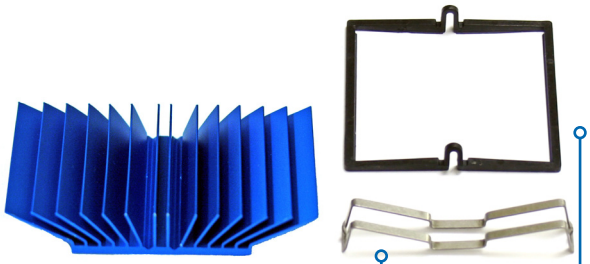
1. Additional constraints may apply if / when heat sinks are used with length or width dimensions that exceed the XA and YA dimensions shown in the table. Please contact ATS for assistance with such applications.
2. Data provided for reference only and may vary by application.
3. ATS reserves the right to update or change its products without notice to improve the design or performance.
4. Contact ATS to learn about custom options available.

ATS ADVANCED THERMAL SOLUTIONS, INC.
Innovations in Thermal Management®

For more information, to find a distributor or to place an order, call 781.769.2800, email ats-hq@qats.com, or visit www.qats.com

superGRIP™ INSTALLATION GUIDE

For all maxiFLOW™ and Straight Fin superGRIP™ Assemblies

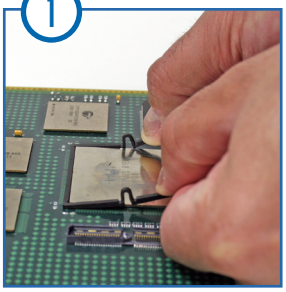


HEAT SINK (HS)

SPRING CLIP (SC)

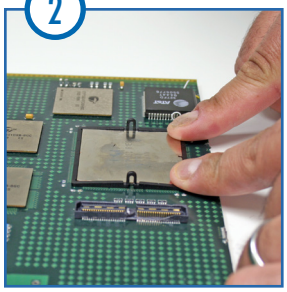
FRAME CLIP (FC)

1



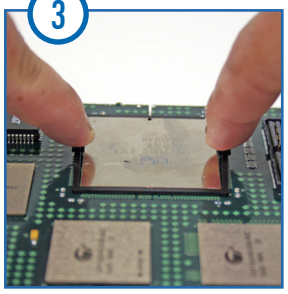
Place FC around two corners of the component. FC will bend slightly at the "horseshoe" tab. Note the direction of air flow when placing your HS.

2



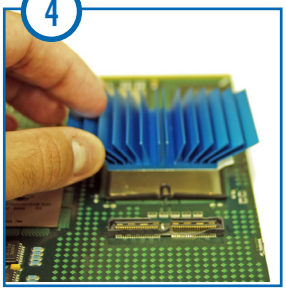
Press opposite end of the FC down until it is secure around the component's edges.

3



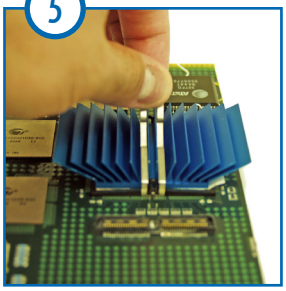
To ensure a secure fit, push spread apart FC slightly at the "horseshoe" tabs while pressing down.

4



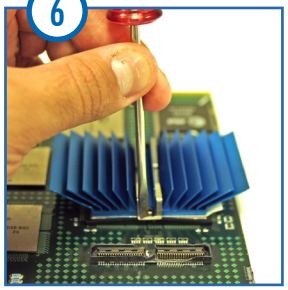
Place HS over the installed FC so that the "horseshoe" tabs of the FC fit within the HS' notches.

5



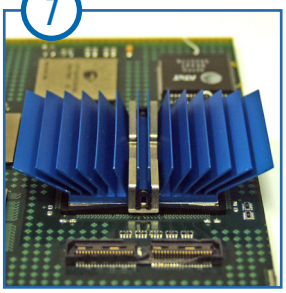
Place spring clip within the HS' fin field as shown. The ends of the SC will fit over the "horseshoe" tabs.

6



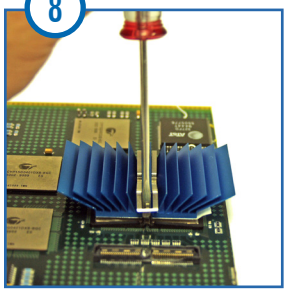
Push opposite end of the SC down over the FC with a small screwdriver until it fits securely on the assembly.

7



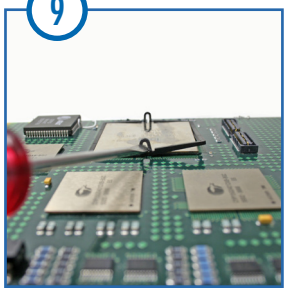
Shown above the is the HS, FC and SC assembly properly seated over the component.

8



To remove, place a small flat-head screwdriver between the spring clip and the frame clip and pry the spring clip away from the frame.

9



Remove the FC by placeing a small screwdriver within the "horseshoe" tab and gently twisting in either direction to pull the frame clip away from the component.

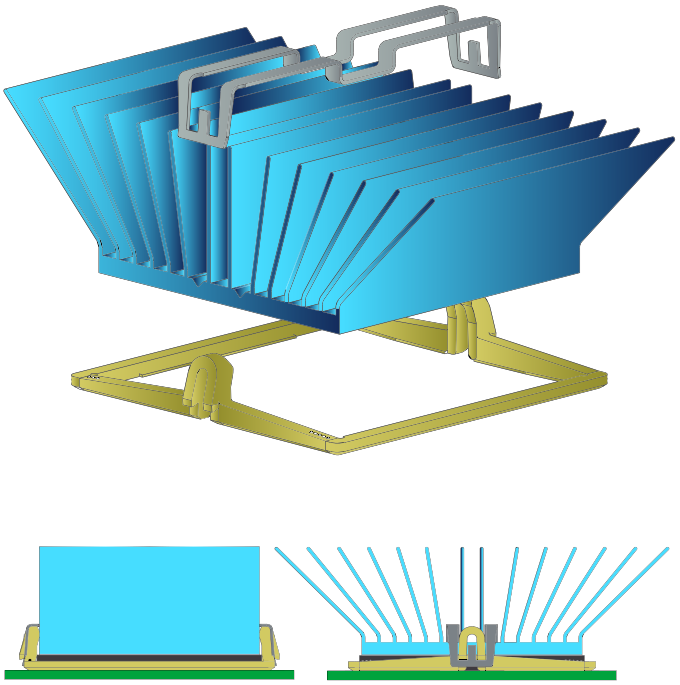
Advanced Thermal Solutions is a leading engineering and manufacturing company supplying complete thermal and mechanical packaging solutions from analysis and testing to final production. ATS provides a wide range of air and liquid cooling solutions, laboratory-quality thermal instrumentation, along with thermal design consulting services and training. For more information about Advanced Thermal Solutions, Inc., please visit www.qats.com or call 781-769- 2800.

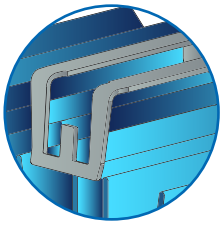
ATS ADVANCED THERMAL SOLUTIONS, INC.
Innovations in Thermal Management®

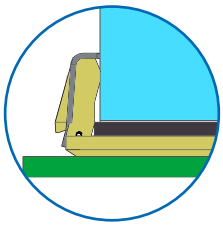
RoHS COMPLIANT

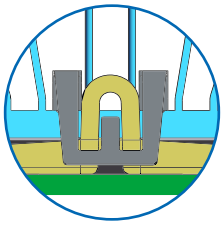
superGRIP™

HEAT SINK ATTACHMENT FOR DENSELY POPULATED PCBS









ATS' superGRIP™ patented frame and spring clips assembly

AVAILABLE COMPONENT SIZES (L X W)

15 mm x 15 mm
17 mm x 17 mm
19 mm x 19 mm
21 mm x 21 mm
23 mm x 23 mm
25 mm x 25 mm
27 mm x 27 mm
29 mm x 29 mm
30 mm x 30 mm
31 mm x 31 mm
32.5 mm x 32.5 mm
33 mm x 33 mm
35 mm x 35 mm
37.5 mm x 37.5 mm
40 mm x 40 mm
42.5 mm x 42.5 mm
45 mm x 45 mm

AVAILABLE HEAT SINK HEIGHTS

7.5 mm
12.5 mm
17.5 mm
(Custom sizes available)

superGRIP™ FEATURES:

- Provides tight, secure heat sink attachment in shock and vibration environments
- superGRIP's strong, uniform attachment force helps achieve maximum performance from high performance phase-changing thermal interface materials
- Allows the heat sink to be detached and reattached without damaging the component or the PCB, an important feature in the event a PCB may need to be reworked
- Comes standard with clean break, reworkable, Chomerics T-766 phase change material

FRAME CLIP:

- Thin, yet strong plastic Frame Clip occupies minimal area around chip, allowing its use in densely populated PCBs
- No custom installation tooling required– mounts easily by hand.
- Interior frame profile locks securely around bottom edge and sides of component package
- Integral horseshoe tabs in clip lock in Spring Clip edges for tight, movement-free heat sink retention
- Frame Clip is easily and safely removed with a common hand tool

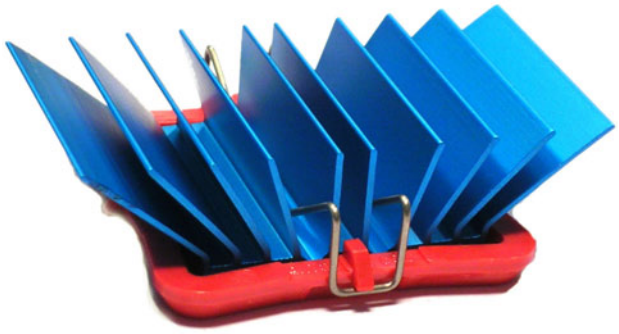
SPRING CLIP:

- Metal spring clip, placed through the heat sink's fin field, locks securely to both ends to the plastic frame and applies steady, even pressure to the component, improving thermal performance and long-term reliability
- Spring Clip design is quickly installed or released using a common hand tool, such as a flat blade screwdriver
- Flat, twin-channel clip provides stronger retention forces and minimizes spring clip movement

maxiGRIP™

THE ULTIMATE HEAT SINK ATTACHMENT SYSTEM

- Provides tight, secure heat sink attachment in shock and vibration environments
- maxiGRIP™ assemblies available for low profile (1.5-2.99 mm) and standard height components (3-4.5 mm)
- Allows the heat sink to be detached and reattached without damaging the component or the PCB
- Steady, even attachment force helps achieve maximum performance from phase-changing TIMs

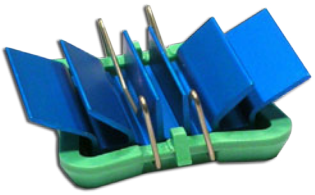


ATS' patented maxiGRIP™ Heat Sink Attachment System

About maxiGRIP™

ATS' maxiGRIP™ is a two-component, attachment system which quickly and securely mounts heat sinks to a wide range of hot running Ball Grid Array (BGA) components, while using a minimal amount of space on the PCB and eliminating the need to drill holes.

The two-part maxiGRIP™ system features a plastic frame clip that fastens securely around the perimeter of a component and a metal spring clip which slips through the heat sink's fin field and locks securely to both ends to the plastic frame. The resulting maxiGRIP™ assembly applies steady, even pressure to the component throughout the product lifecycle, improving thermal performance and long-term reliability.



ATS offers two tiers of heat sink clip attachment: maxiGRIP™, for general purpose and high performance applications: and superGRIP™, for high performance applications with densely populated PCBs and little space around the component for mechanical attachment.

ATS' maxiGRIP™ heat sink attachment system permits the use of high performance phase changing thermal interface materials that improve heat transfer by as much as 20 times more than typical double-sided adhesive thermal tapes. It also allows for the heat sink to be detached and reattached without damaging the component or the PCB, an important feature for applications where PCB rework and ease of assembly and disassembly are important.

The maxiGRIP™ system is available with ATS' maxiFLOW™ family of heat sinks, which feature a low profile, spread fin architecture to maximize surface area for more effective convection (air) cooling. Testing at an air flow rate of just 0.5 m/s (100 ft/m) shows that device junction temperatures (Tj) can be reduced by more than 20 percent below the temperatures achieved using heat sinks with traditional fin styles.

It is also available with ATS' straight fin and cross cut heat sinks, as well as additional sizes and configurations, as custom options.

For further technical information, please contact Advanced Thermal Solutions, Inc. at 1-781-769-2800 or www.qats.com

maxiGRIP™ FEATURES:

» Least Flow Resistance
maxiGRIP's low profile frame clip and minimal cross-sectional area of the spring clip permits maximum air flow through the heat sink

» Improves Performance
maxiGRIP's steady, even attachment force helps achieve maximum performance from phase-changing thermal interface materials

» Easy Installation and Removal
Allows heat sink to detached and reattached without damaging the PCB.

» Thermal Interface Material
Comes standard with clean-break, reworkable, Chomerics T-766 phase change material

» Frame Clip
Plastic clip meets UL-94V-0 fire rating and exceptional thermal stability

» Spring Clip
Double "M" configuration provides even force distribution

» No Special Tools Needed
Frame and spring clips can both be installed by hand or with the maxiGRIP™ Installation Tool for greater ease & efficiency

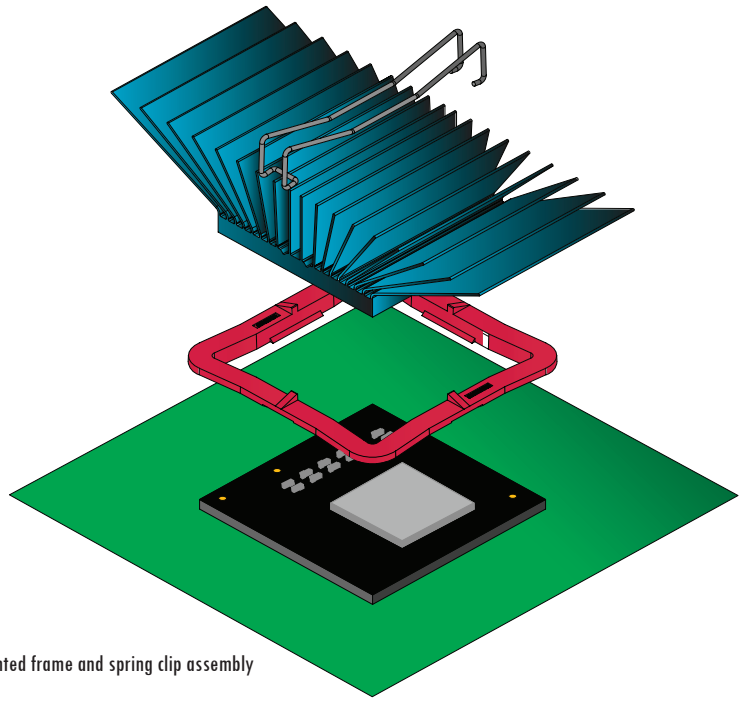
» maxiFLOW™ Heat Sink
Available with maxiFLOW™ heat sinks which maximize surface area for more effective convection (air) cooling

» Custom Options
Clips and heat sink can be customized in different sizes

maxiGRIP™

THE ULTIMATE HEAT SINK ATTACHMENT SOLUTION

RoHS COMPLIANT



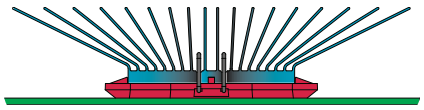
ATS' maxiGRIP™ patented frame and spring clip assembly

AVAILABLE COMPONENT SIZES (L X W)

15 mm x 15 mm
17 mm x 17 mm
19 mm x 19 mm
21 mm x 21 mm
23 mm x 23 mm
25 mm x 25 mm
27 mm x 27 mm
29 mm x 29 mm
30 mm x 30 mm
31 mm x 31 mm
32.5 mm x 32.5 mm
33 mm x 33 mm
35 mm x 35 mm
37.5 mm x 37.5 mm
40 mm x 40 mm
42.5 mm x 42.5 mm
45 mm x 45 mm

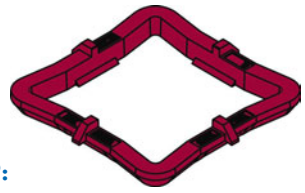
AVAILABLE HEAT SINK HEIGHTS

7.5 mm
12.5 mm
17.5 mm
(Custom sizes available)



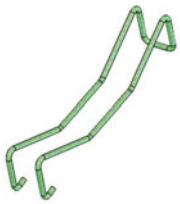
maxiGRIP™ FEATURES:

- Provides tight, secure heat sink attachment in shock and vibration environments
- maxiGRIP's steady, even attachment force helps achieve maximum performance from high performance phase-changing thermal interface materials
- Allows the heat sink to be detached and reattached without damaging the component or the PCB, an important feature in the event a PCB may need to be reworked
- Comes standard with clean break, reworkable, Chomerics T-766 phase change material



FRAME CLIP:

- High-strength, high-performance plastic meets stringent UL-94V-0 fire rating which has exceptional thermal stability
- Frame geometry has been optimized for strength and minimal space requirements
- Tapered wall provides clearance for adjacent components
- Hour glass shape provides additional room for metal spring clip
- Uniformity in design allows for omnidirectional frame clip orientation



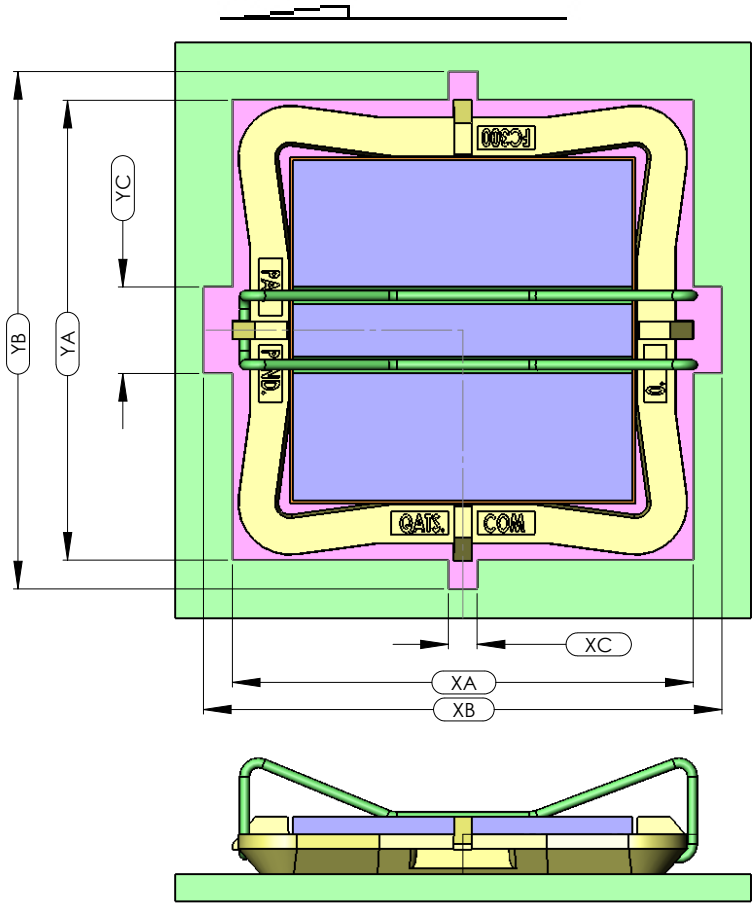
SPRING CLIP:

- Metal spring clip, placed through the heat sink's fin field, locks securely to both ends to the plastic frame
- Double "M" shape provides steady, even pressure to the component, improving thermal performance and long-term reliability
- Spring clip is quickly installed with the maxiGRIP™ Installation Tool
- Specifically designed for different component heights.
- Imposes minimal restriction to air flow
- Accommodates varied fin-to-fin spacing

maxiGRIP™ Clearance Guidelines

Required Board Keep Out Region for maxiGRIP™ Heat Sink Attachment Hardware

DIRECTION OF AIR FLOW



NOM SIZE	XA	XB	XC	YA	YB	YC
17 x17	23.0	31.0	NA	23.0	23.0	11.0
19 x 19	27.0	31.0	2.5	27.0	31.0	8.0
21 x 21	29.0	33.0	2.5	29.0	33.0	8.0
23 x 23	32.5	36.5	2.5	32.5	36.5	8.0
25 x 25	34.0	38.0	2.5	34.0	38.0	8.0
27 x 27	36.0	40.0	2.5	36.0	40.0	8.0
29 x 29	38.5	42.5	2.5	38.5	42.5	8.0
30 x 30	40.0	44.0	2.5	40.0	44.0	8.0
31 x 31	41.0	45.0	2.5	41.0	45.0	8.0
32.5 x 32.5	43.0	47.0	2.5	43.0	47.0	8.0
33 x 33	43.5	47.5	2.5	43.5	47.5	8.0
35 x 35	45.5	49.5	2.5	45.5	49.5	8.0
37.5 x 37.5	48.5	52.5	2.5	48.5	52.5	8.0
40 x 40	52.0	56.0	2.5	52.0	56.0	8.0
42.5 x 42.5	54.5	58.5	2.5	54.5	58.5	8.0
45 x 45	57.0	61.0	2.5	57.0	61.0	8.0

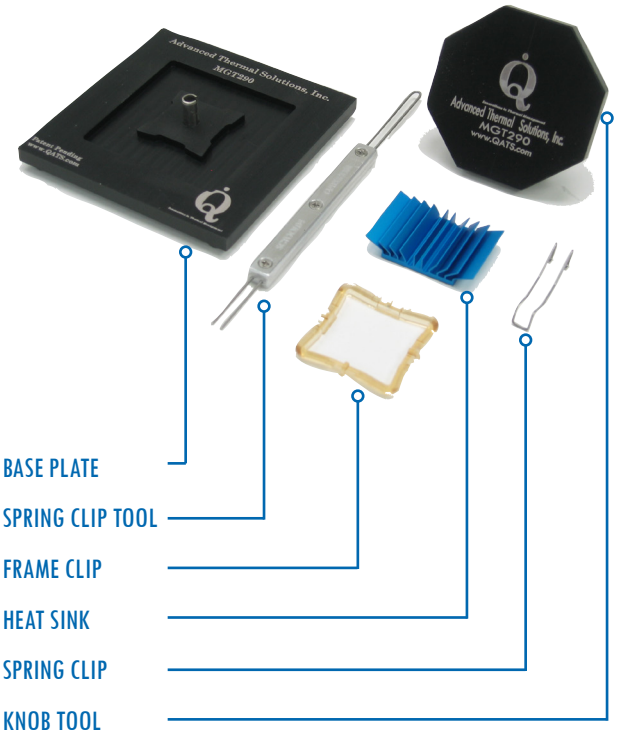
NOTES:

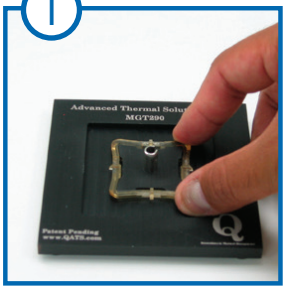
1. Additional constraints may apply if / when heat sinks are used with length or width dimensions that exceed the XA and YA dimensions shown in the table. Please contact ATS for assistance with such applications.
2. Data provided for reference only and may vary by application.
3. ATS reserves the right to update or change its products without notice to improve the design or performance.
4. Contact ATS to learn about custom options available.

ATS ADVANCED THERMAL SOLUTIONS, INC.
Innovations in Thermal Management®

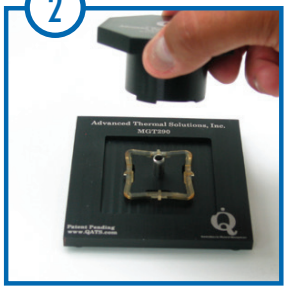
For more information, to find a distributor or to place an order, call 781.769.2800, email ats-hq@qats.com, or visit www.qats.com

maxiGRIP™ INSTALLATION GUIDE

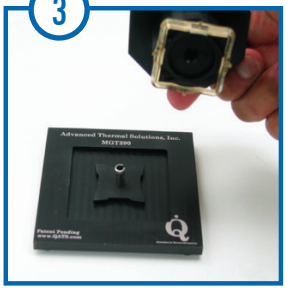




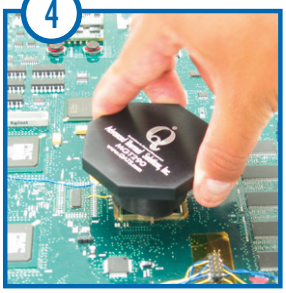
1 Place Frame Clip into pocket of tooling Base Plate.



2 Position the Knob Tool over the Frame Clip

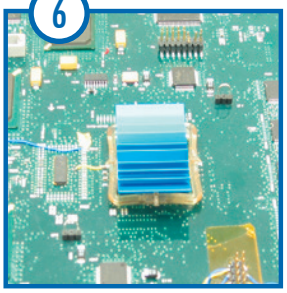


3 Rotate the knob tool 45° clock-wise locking the Frame Clip to the Knob Tool and lift away from base plate.

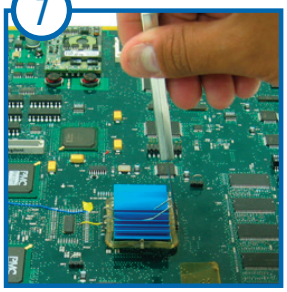


4 Position the Knob Tool with Frame Clip over the component, rotate 45° counter-clockwise releasing the Frame CLip

5 Lift to remove the Knob Tool - leaving the Frame Clip attached to the component.

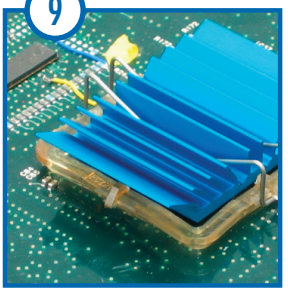


6 Place the Heat Sink squarely in the Frame Clip over the component. Note the direction of air flow when placing your Heat Sink.



7 Secure the "Open End" of the Spring Clip under the lip of the frame clip.

8 Using the "Forked End" of the Spring Clip tool, "latch over" the "Closed End" of the Spring Clip on to the Frame Clip tab.



9 Inspect the installation. Double check to make sure the Heat Sink is securely attached.

Advanced Thermal Solutions is a leading engineering and manufacturing company supplying complete thermal and mechanical packaging solutions from analysis and testing to final production. ATS provides a wide range of air and liquid cooling solutions, laboratory-quality thermal instrumentation, along with thermal design consulting services and training. For more information about Advanced Thermal Solutions, Inc., please visit www.qats.com or call 781-769- 2800.

ATS ADVANCED THERMAL SOLUTIONS, INC.
Innovations in Thermal Management®

89-27 ACCESS ROAD, NORWOOD, MA 02062 USA | T: 781.769. 2800 | ATS-HQ@QATS.COM | WWW.QATS.COM

Thermal Test Instruments

Advanced Thermal Solutions, Inc. (ATS) designs and fabricates the most extensive line of thermal test instruments specifically designed for the electronics industry. These research-quality, state-of-the-art instruments include Pressure, Temperature and Velocity Measurement Systems, Airflow and Heat Flux Controllers, Open- and Closed-Looped Wind Tunnels, Micron-level Thermography Systems and Cold-Plate Thermal Characterization Systems. One such instrument is the iQ-200™, which is the only device in the industry that measures temperature, velocity and pressure in a single system. All systems are supported with data acquisition/reduction software** based on LabView™

ATVS-2020™

Hot wire anemometer with up to 32 channels for measuring temperature & velocity**

ATVS-NxT™

Hot wire anemometer with touch screen PC and up to 32 channels for measuring temperature & velocity**

eATVS™

Hot wire anemometer with 4 or 8 channels for measuring temperature & velocity**

iQ-200™

A single system for measuring temperature, velocity & pressure**

iFLOW-200™

An automatic system for cold plate characterization**

thermVIEW™

High resolution liquid crystal thermography system**

CLWT-115™

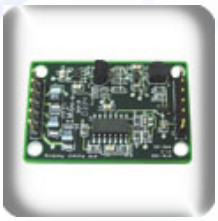
Closed loop wind tunnel with elevated temperatures up to 85°C and 8m/s**

CWT-108™

Open loop wind tunnel for component, heat sink & PCB testing

BWT-104™

Bench top wind tunnel for component, heat sink & PCB testing



ISD™

Analog hot wire anemometer board for measuring temperature & velocity

HFC-100™

A system for controlling & measuring heat flux up to 1,000 w/cm²**

WTC-100™

Wind tunnel controller for automation of wind tunnel testing** (Supports all ATS Wind Tunnels)

DAC-200™

General purpose digital-to-analog converter with 32 channels**

CIP-1000™

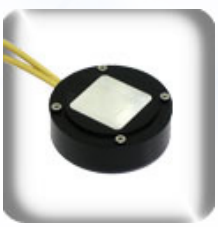
A controllable isothermal plate system for component & PCB testing**

PTM-1000™

A transducer for measuring for static and differential pressures with 4 to 8 channels**

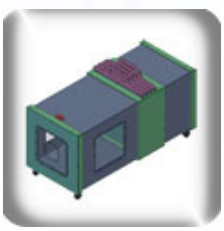
Sensors

Hot wire anemometer sensors measure temperature & air velocity with minimal flow disturbance



HP-97™

Power module for simulating heat dissipating components



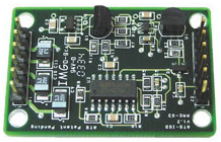
FCM-100™

Fan characterization module fr generating PQ curves for a single fan or fan tray**

HOT WIRE ANEMOMETER DEVICES

TEMPERATURE, VELOCITY, AND PRESSURE MEASUREMENT

ATS offers a wide selection of Hot Wire Anemometer Devices that measure temperature, velocity, and pressure. All instruments use our patented single-sensor technology, which eliminates errors introduced as a result of the air flow being non-isothermal. The iQ-200™ is the only device in the industry that measures temperature, velocity and pressure with a single-system.



ISD™

eATVS™

ATVS-2020™

ATVS-NxT™

iQ-200™

Technical Comparison

Features	ISD™	eATVS™	ATVS™	ATVS-NxT™	iQ-200™
Measures Surface Temperature	✓	✓	✓	✓	✓
Measures Air Temperature	✓	✓	✓	✓	✓
Measures Velocity	✓	✓	✓	✓	✓
Measures Pressure	x	x	x	x	✓
No. of Channels	1	4 or 8	4 to 32	4 to 32	16
Temperature Range	-20°C to 120°C	-20°C to 120°C	-20°C to 120°C	-20°C to 120°C	-40°C to 750°C
Temperature Accuracy	+/- 1°C	+/- 1°C	+/- 1°C	+/- 1°C	+/- 1°C
Velocity Range	0 to 10,000 fpm (0 to 50 m/sec)	0 to 10,000 fpm (0 to 50 m/sec)	0 to 10,000 fpm (0 to 50 m/sec)	0 to 10,000 fpm (0 to 50 m/sec)	0 to 10,000 fpm (0 to 50 m/sec)
Temperature Range for Velocity	20°C to 85°C	20°C to 85°C	20°C to 85°C	20°C to 85°C	20°C to 85°C
Velocity Accuracy (% of Reading)	+/- 2 %	+/- 2 %	+/- 2 %	+/- 2 %	+/- 2 %
Pressure Range	N/A	N/A	N/A	N/A	0 to 1,035Pa (0 to 0.15 psi)
Pressure Accuracy	N/A	N/A	N/A	N/A	1% of full scale
Software	stageVIEW™	stageVIEW™	stageVIEW™	stageVIEW™	IQstage™
Power	DC power supply	DC power supply	DC power supply	110V or 220V	110V or 220V
Analog	0-5 VDC	x	x	x	x
Interface USB	x	✓	✓	N/A	✓
Weight	6 grams	4 lbs (2kg)	10 lbs (5kg)	15 lbs (7.5kg)	15 lbs (6.8kg)
Depth/Length	1.60” (40.6 mm)	9.2” (23.4 cm)	11.0” (27.9 cm)	15.0” (38 cm)	16.9” (43 cm)
Width	1.06” (26.98 mm)	5.3” (13.4 cm)	13.5” (34.3 cm)	19” (48 cm)	13.4” (34 cm)
Height	0.41” (10 mm)	2.5” (6.5 cm)	5.3” (13.5 cm)	7.5” (19 cm)	5.0” (12.6 cm)
UL Components	✓	✓	✓	✓	✓
Standalone	x	x	x	✓	x
Measurement Duration	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Notes					12 thermocouples 4 pressure sensors

SENSORS

ATS-Patented Single-Sensor Technology

Advanced Thermal Solutions revolutionized the industry in the late 1990s with the introduction of its patented, single-sensor technology, which measures temperature and velocity with a single sensor and eliminates errors attributable to non-isothermal air flow. It broke a second paradigm when it followed years later with the production of its Candlestick sensor, a 360^0 reading sensor, offering the least invasive profile in the test domain, thus insuring the highest accuracy. Altogether, ATS presents eight different profiles and over a hundred variations in customization for its very selective and loyal instrumentation customers.

Candlestick Sensor

Multi-Sensor in Plane

Multi-Sensor PBL

Hand-Held Probe

Hand-Held Surface Probe

Traversing Probe

Micro Sensor

Spot Sensor

Technical Comparison

Product	Base Diameter	Height/Length	Temperature Range	Velocity Range
Candlestick Sensor	0.37” (9.5 mm)	0.35”, 0.47”, 0.78” (9 mm, 12 mm, 20 mm)	-20°C to 120°C	0 to 51 m/s (10,000 ft/min)
Multi Sensor In Plane MS 1000-IP-20	0.60” (15.2 mm)	0.53”, 0.73”, 0.92” (13 mm, 18 mm, 23 mm)	-20°C to 120°C	0 to 51 m/s (10,000 ft/min)
Multi Sensor PBL MS 1000-PBL-20	0.60” (15.2 mm)	0.53”, 0.73”, 0.92” (13 mm, 18 mm, 23 mm)	-20°C to 120°C	0 to 51 m/s (10,000 ft/min)
Hand Held Probe HHP-A	N/A	24” (609.6 mm)	-20°C to 120°C	0 to 51 m/s (10,000 ft/min)
Hand Held Surface Probe HP 1000-SP	N/A	6” (150 mm)	-20°C to 120°C	N/A
Traversing Probe TP 1000-20	N/A	6” (150 mm)	-20°C to 120°C	0 to 51 m/s (10,000 ft/min)
Micro Sensor MIC 1000-20	N/A	1.5” (38.1 mm)	-20°C to 120°C	0 to 51 m/s (10,000 ft/min)
Spot Sensor SP 1000-20R1	N/A	Custom	-10°C to 150°C	N/A

CLOSED LOOP WIND TUNNELS

WIND TUNNELS FOR ALL TESTING NEEDS

Advanced Thermal Solutions offers a comprehensive selection of research-grade closed-loop wind tunnels for companies in the electronics and power industries, ranging in weight from 156 to 2300 pounds and in height from 27" to 124". Whether your needs can be handled by a bench-top version or room-sized version, ATS is there to meet your needs.

Technical Comparison

Product	Length	Width	Height	Weight	Test Domain (L x W x D)	Sensor Ports	Flow Range	Temperature Range
CLWT-067	143.6 cm (56.5")	49.3 cm (19.4")	26.6" (67.7 cm)	70.7 kg (156 lbs)	41.8 x 22.5 x 9.5 cm (16.4" x 8.9" x 3.7")	6	0 to 7 m/s (0 to 1400 fpm)	-10°C to 85°C (52°F to 185°F)
CLWT-115	221 cm (87")	(49.3 cm (19.4")	34" (86.5 cm)	102 kg (226 lbs)	77.6 x 26 x 11.5 cm (30.5 x 10.2 x 4.5")	6	0 to 5 m/s (0 to 1000 fpm)	-10°C to 85°C (52°F to 185°F)
CLWT-100	285 cm (112")	114 cm (45")	78" (198 cm)	900 kg (2000 lbs)	30 x 30 x 30 cm (12 x 12 x 12")	24	0 to 4 m/s (0 to 800 fpm)	-10°C to 85°C (52°F to 185°F)
CLWT-150	356 cm (140")	127 cm (50")	99" (251 cm)	997 kg (2200 lbs)	45 x 45 x 45 cm (18 x 18 x 18")	24	0 to 4 m/s (0 to 800 fpm)	-10°C to 85°C (52°F to 185°F)
CLWT-200	330 cm (130")	127 cm (50")	315 cm (124")	1043 kg (2300 lbs)	61 x 61 x 61 cm (24 x 24 x 24")	24	0 to 4 m/s (0 to 800 fpm)	-10°C to 85°C (52°F to 185°F)

*Please note temperature ranges below ambient requires refrigeration system

CLWTC-1000™ - Wind Tunnel Controller

Custom-built for the **CLWT-067™** and **CLWT-115™** closed loop wind tunnels, the **CLWTC-1000™** is designed to automatically control the air flow and temperature through the test chamber. It minimizes the chances for errors attributed to the use of multiple and/or less capable controlling devices.

CLWTC-1000™

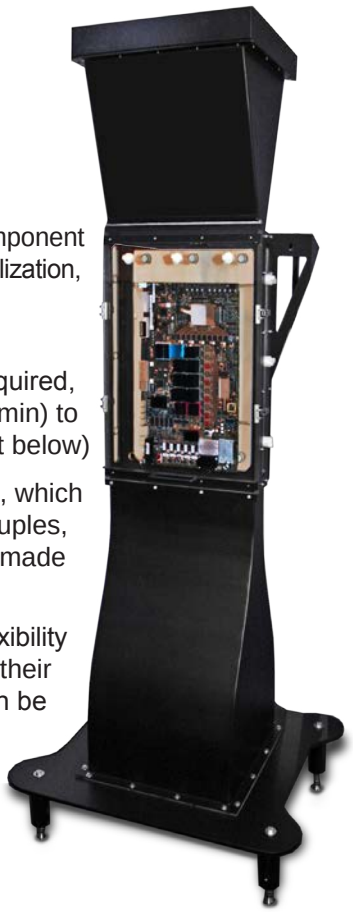
CLWT-100™
CLWT-150™
CLWT-200™

CLWT-067™

CLWT-115™

CWT Series

CONTROLLED OPEN LOOP WIND TUNNEL



These research quality wind tunnels are designed for PCB and component level testing. They are used in air flow characterization and flow visualization, thermal resistance measurements and generation of P-Q curves.

Fans are tray-mounted and easily replaced with another tray to accommodate larger or smaller fans. If other flow ranges are required, the air velocity in the test section can be varied from 0 m/s (0 ft/min) to 10 m/s (2000 ft/min) with the fan tray that is provided. (see chart below)

There are sensor ports on the front and sides of the test section, which allows for the insertion of a variety of probes, such as thermocouples, Pitot tubes, velocity measuring sensors, etc. The test section is made of Plexiglas™ for ease of flow visualization.

PCBs are mounted on a flexible railing in the test section. The flexibility of the movable mounting plate allows users to design and build their own modifications to suit specific needs. The mounting plate can be adjusted in two directions using appropriate length standoffs.

The wind tunnel has honeycombs and screens to suppress turbulence and provide uniform and near homogeneous flow at the test section. A mounted diffuser at the exit and before the fans helps with pressure recovery to provide a smooth flow.

* Power supply not included.

Product	Length	Width	Depth	Weight	Test Domain (L x W x D)	Sensor Ports	Velocity Range	Fans
CWT-100	197.6 cm (77.8")	81.3 cm (32")	68.6 cm (27")	51.7 kg (114 lbs)	61 x 40.6 x 8.3 cm (24 x 16 x 3.3")	18	0 to 10 m/s (0 to 2000 fpm)	Four 24 VDC
CWT-104	198 cm (78")	107 cm (42")	86 cm (34")	74 kg (164 lbs)	61 x 61 x 10 cm (24 x 24 x 4")	18	0 to 9 m/s (0 to 1800 fpm)	Five 24 VDC
CWT-105	198 cm (78")	107 cm (42")	86 cm (34")	75 kg (165 lbs)	61 x 61 x 12.7 cm (24 x 24 x 5")	18	0 to 7 m/s (0 to 1400 fpm)	Five 24 VDC
CWT-106	195.6 cm (76.9")	101.6 cm (40")	84.8 cm (33.4")	72 kg (159 lbs)	61 x 61 x 15.2 cm (24 x 24 x 6")	18	0 to 6 m/s (0 to 1200 fpm)	Five 24 VDC
CWT-107	197.7 cm (77.84")	101.6 cm (40")	77.2 cm (30.4")	70 kg (155 lbs)	61 x 61 x 17.8 cm (24 x 24 x 7")	18	0 to 5.5 m/s (0 to 1100 fpm)	Five 24 VDC
CWT-108	195 cm (77")	101 cm (40")	83 cm (33")	88 kg (193 lbs)	61 x 61 x 20.3 cm (24 x 24 x 8")	18	0 to 5.5 m/s (0 to 1100 fpm)	Five 24 VDC
CWT-109	203.2 cm (80")	107 cm (42")	89 cm (35")	88.4 kg (195 lbs)	61 x 61 x 22.9 cm (24 x 24 x 9")	18	0 to 5 m/s (0 to 1000 fpm)	Five 24 VDC
CWT-110	213.4 cm (84")	107 cm (42")	100 cm (40")	90 kg (198 lbs)	61 x 61 x 25.4 cm (24 x 24 x 10")	18	0 to 4.5 m/s (0 to 900 fpm)	Five 24 VDC
CWT-112	223.5 cm (88")	107 cm (42")	114 cm (45")	91 kg (201 lbs)	61 x 61 x 30.5 cm (24 x 24 x 12")	18	0 to 3.2 m/s (0 to 750 fpm)	Five 24 VDC
CWT-125	238.8 cm (94")	107 cm (42")	152 cm (60")	95 kg (210 lbs)	61 x 61 x 63.5 cm (24 x 24 x 25")	18	0 to 2 m/s (0 to 400 fpm)	Six 24 VDC

For further technical information, please contact Advanced Thermal Solutions, Inc. at 1-781-769-2800 or www.qats.com

FEATURES:

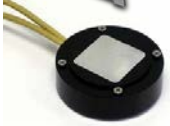
- **Component Temperature Testing**
  Evaluate the effects of airflow on components, temperature and PCB response and reliability
- **Heat Sink Characterization**
  Characterize a variety of heat sink sizes for natural and forced convection cooling
- **Sensor Calibration**
  Uniform velocity profile at the test section allows accurate calibration of sensors
- **Heat Sink Comparison**
  Test two heat sinks side by side and compare their thermal performance in the same environment
- **Pressure Drop Testing**
  Measure pressure drop across components or PCB for a given flow
- **Multiple PCB Testing**
  Test actual or simulated PCBs for thermal and flow distribution
- **Flow Visualization**
  Observe air flow distribution in the tunnel by smoke or buoyant bubbles through the all Plexiglas™ test section
- **Variable Speed**
  Change flow rates by controlling the fan RPM
- **Quick Access**
  Quickly change the test specimen through the front access test section
- **Sensor Ports**
  Measure pressure, velocity and temperature through the sensor ports
- **Orientation**
  Wind tunnel can be operated horizontally or vertically

RECOMMENDED ACCESSORIES:

WTC-100™
Wind Tunnel Controller

CLWTC-1000
Wind Tunnel Controller

ATVS-NxT™
Hot Wire Anemometer



HP-97™
High Power Component Simulator