

Compact, High Performance Air-Cooled Heat Sinks

Custom, compact, high performance air-cooled heat sinks, shown in Figure 1, designed to meet the most demanding electronics cooling requirements in both commercial and military applications. This product is the result of the DARPA Research & Development program, entitled Micro-technologies for Air-Cooled Exchangers (MACE), to advance the air side heat transfer performance over current State-of-the-Art heat sinks. The unique design integrates Therma-Base® Vapor Chamber technology within a truly 3-Dimensional heat pipe cooling product, where the vapor flow spreads the heat both laterally in the base and into planar appendage heat pipe blades for a highly efficient, isothermal 3D heat sink. Attached to the planar blades are high density rolled and louvered fins, resulting in an isothermal, high surface area, air-cooled heat sink with exceptionally low thermal resistance and high coefficients of performance.

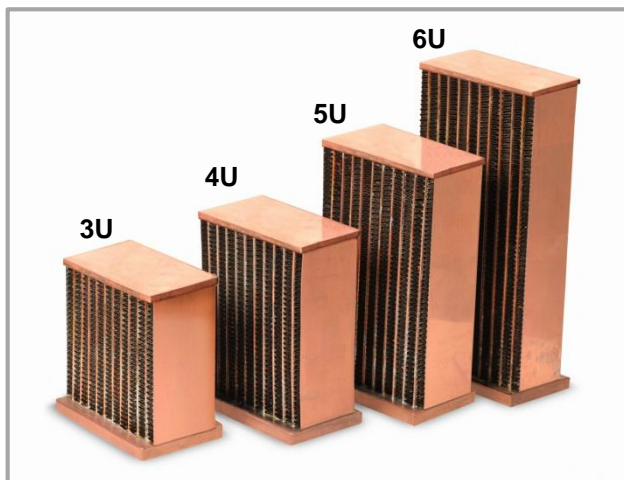


Figure 1 – Compact, High Performance Air-Cooled Heat Sinks for 3U to 6U Electronics Formats

Key Features:

- ▶ Compact
- ▶ Highly Reliable Passive Device
- ▶ Integrated Air-to-Air Compact Heat Exchanger
- ▶ High Volumetric Isothermally
- ▶ Available with COTS Fans
- ▶ Available for 3U to 6U Enclosures and Larger

Key Benefits

- ▶ Excellent Thermal Uniformity (shown in Figure 2)
- ▶ Ultra-low Thermal Resistance (shown in Figure 4)
- ▶ Lower Electronic Component Temperatures
- ▶ Longer Microprocessor Life and Reliability
- ▶ Compact Design with integrated Heat Exchanger
- ▶ Passive (i.e. no liquid pumps)
- ▶ Scalable and Reconfigurable Design
- ▶ Available in 3U, 4U, 5U, and 6U Formats (Example 4U shown in Figure 3)

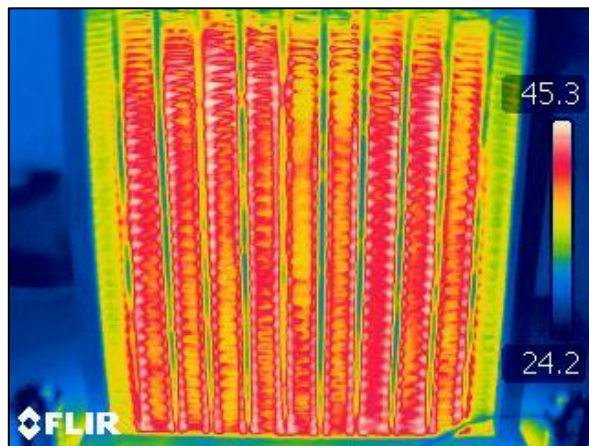


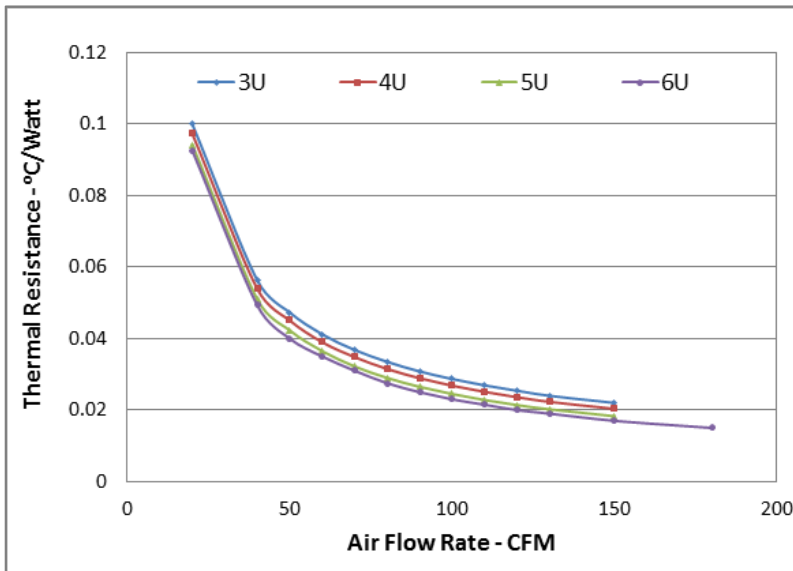
Figure 2 – Thermal Image of a 4U Heat Exchanger at 1000 watts dissipation.



Figure 3 – Example of a Complete 4U Assembly with fan, shroud, and mounting hardware.

Specifications – High Performance Air-Cooled Heat Sinks					
Power / Heat Load	250 to 2000 Watts depending on model.				
Performance	See Performance Curves shown in Figure 4.				
Materials of Construction	Wall – Copper Wick – Copper Fin - Aluminum				
Working Fluid	Water or Methanol				
Model	3U	4U	5U	6U	6U 2 Fans
Typical Air Flow Rate (CFM)	75	90	95	100	180
Dimensions (L x W x H) in. With fan	4 x 4 x 3.8	4 x 4 x 4.2	4 x 4 x 5.9	4 x 4 x 7.6	4 x 4 x 7.6
Mass (grams) without fan	600	700	900	1100	1100
Coefficient of Performance (@30°C ΔT)	33	33	38	42	27
Fan Specifications	Model	3U		4U-6U	
	Voltage Power Size	12-28 VDC 25 Watts 80 mm		12-28 VDC 30 Watts 90 mm	
Max. Operating Temperature	65 to 100°C				
Storage Temperature Range	-55°C to +100°C				
Mounting Features	Customized for each Application				

Figure 4 – Thermal Resistance vs. Airflow Rate
95mm x55mm Heat Input Area



Critical Application Needs

- ▶ Computer Server Microprocessors
- ▶ Military Electronics Cooling
 - ATX Chassis
 - Embedded Computing Applications
 - Avionics in Unmanned and Manned Aircraft
 - Vetrronics in Ground and Surface Vehicles
 - Mobile Electronics
 - Military Radars
 - Microwave/RF
- ▶ Power Electronics and Power Converters
 - ▶ Telecommunication Electronics
 - ▶ Medical Equipment Electronics

Other Related Technologies

- ▶ Embedded Heat Pipe Assemblies
- ▶ Therma-Base[®] Vapor Chambers
- ▶ VME/VPX Cold Plates
- ▶ k-Core[®] Annealed Pyrolytic Graphite (APG)
- ▶ Air-to-Air Heat Exchangers