



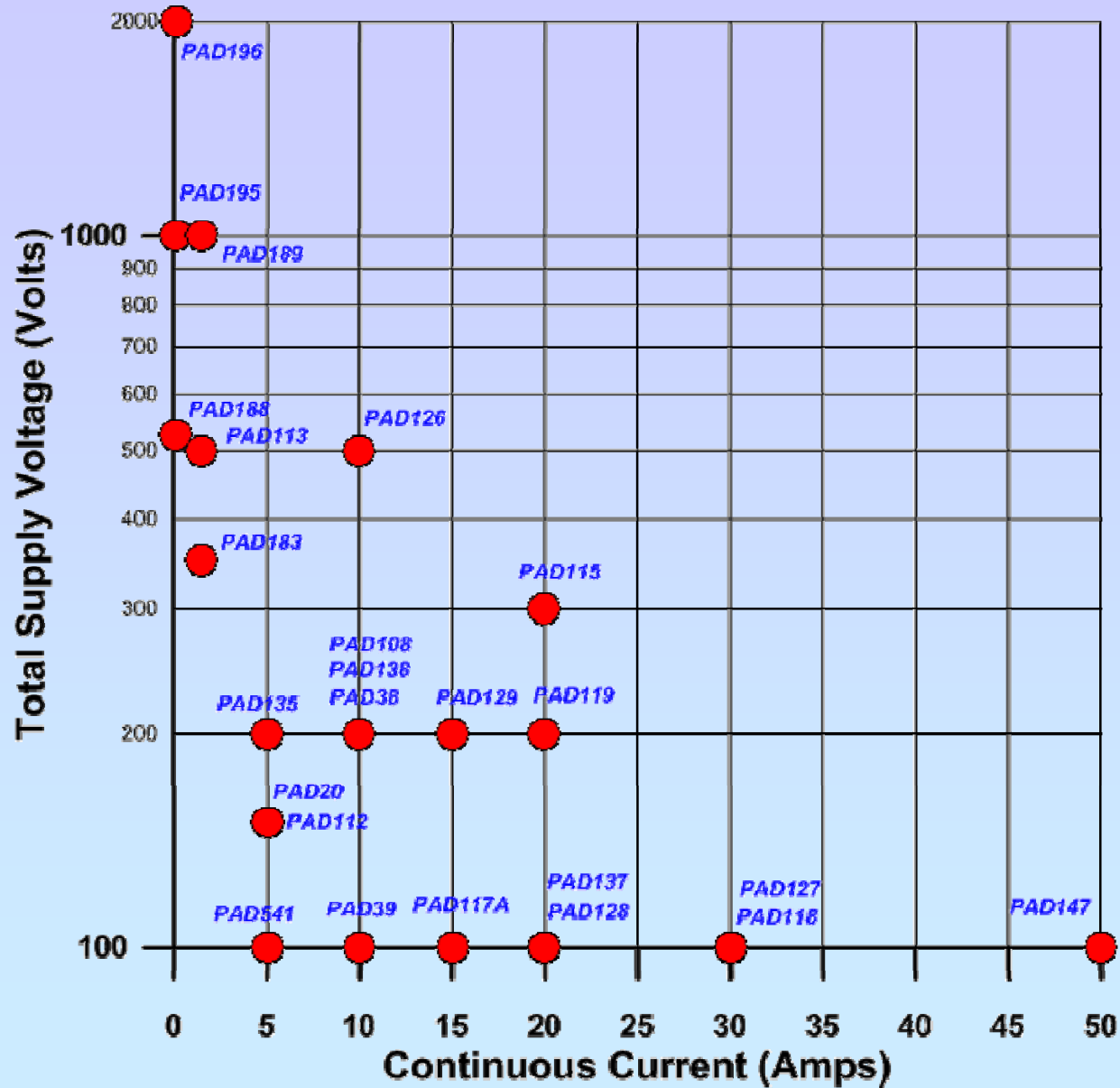
Power Amp Design

Simple Power Op Amp Solutions

About **PAD**

- **PAD** was founded in 2002 to develop a new generation of power op amps for industrial applications
- **PAD** amplifier products span a voltage range of 100 to 2000V, current ratings from 50mA to 50A and a power dissipation range from 5W to 300W with footprints ranging from 30mm square to 90mm square
- Typical applications for **PAD** products include:
 - Brush motor drive
 - Sonar transducer drive
 - Industrial Ink Jet Print Head Drive
 - Scanning tunneling microscopes
 - ATE pin drivers
 - Ultra-sound transducer drive
 - Scientific instrumentation
 - Semi-conductor capital equipment

Amplifier V/I Matrix



PAD Design Goals

- The new **PAD** products have achieved their power op amp design goals:
 - Replace aging industry hybrid amplifiers with more modern and cost effective designs
 - Improve power amplifier performance at a lower cost than hybrid designs
 - Provide an integrated cooling solution
 - Provide a compact simple plug & play power amplifier solution

PAD Design Support

- All **PAD** products are supported with:
 - Expert applications assistance
 - SPICE models for common circuit simulators
 - Evaluation kits for each model
 - **PAD Power**[™], our Excel based design verification spreadsheet
 - Accessory modules to modify or enhance normal amplifier operation
 - Custom designs with or without heat sinks & fans

PAD New Concepts

- **PAD** high power op amps offer a new concept: an integrated heat sink and fan optimize amplifier cooling while decreasing size and increasing power density
- **PAD** amplifiers are constructed with low cost surface mount technology on an insulated metal substrate and uses no beryllium oxide (BeO).
- **PAD** optional accessory modules to enhance amplifier performance

PAD Amplifier Advantages

- Compact plug-in designs with integrated *active* and *passive* heat sink cooling
- Amplifier temp range from -40C to +105C (designs without fan and -55C to +125C temp range available on special request)
- No separate components to procure or assemble (heat sink, thermal “grease”, amplifier)
- Real-world power ratings (not relative to the “infinite” heat sinks of competitive products)
- Best technical specifications available
- Many amplifier models offer thermal shutdown and analog temperature output voltage
- Extensive “accessory” modules offered

Active Cooling Comparisons

- Both heat sinks shown have a thermal resistance of $0.5^{\circ}\text{C}/\text{Watt}$
- Aavid *passive* heat sink volume is 100 in^3 and weighs 73 oz.
- **PAD** *active* heat sink volume is only 4.6 in^3 and weighs only 4 oz.
- **PAD** cooling fan consumes only 1.5 watts



Aavid/Thermolloy heat sink
 $0.5\text{C}/\text{Watt}$

A large, black, passive heat sink with a series of vertical fins, shown at an angle.

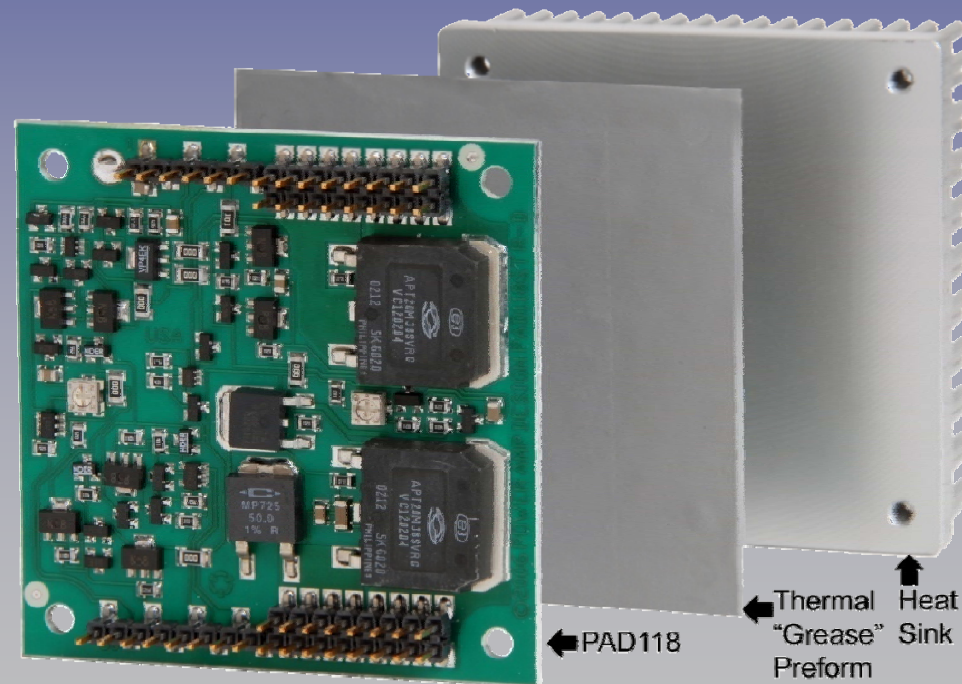


Power Amp Design heat sink
 $0.5\text{C}/\text{Watt}$ (with fan)

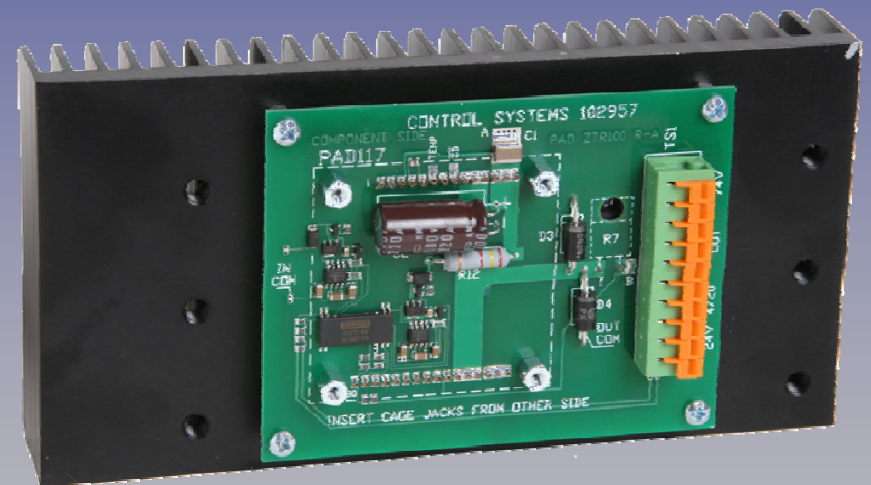
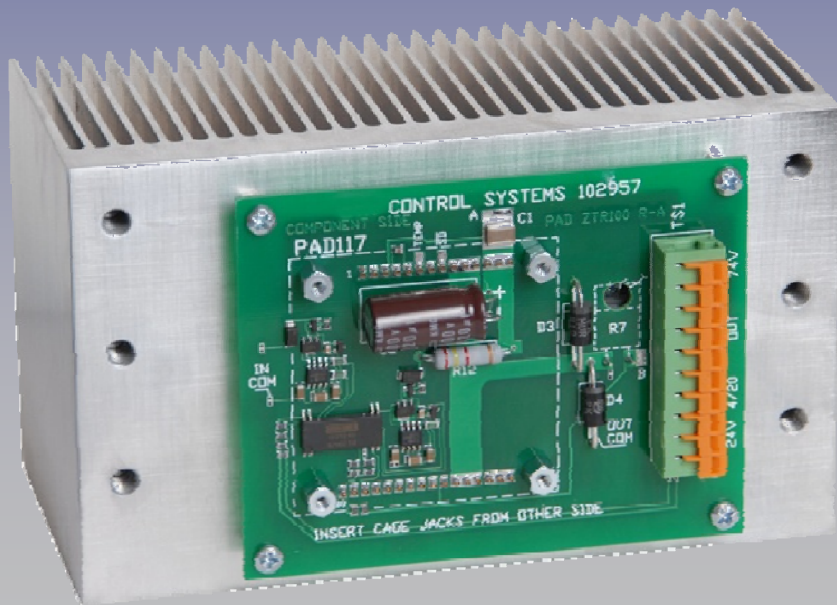
A smaller, grey, active heat sink with a dense array of small vertical pins, shown at an angle.

Amplifier Attachment

- Amplifier pre-attached to heat sink with heat and pressure for a high quality interface



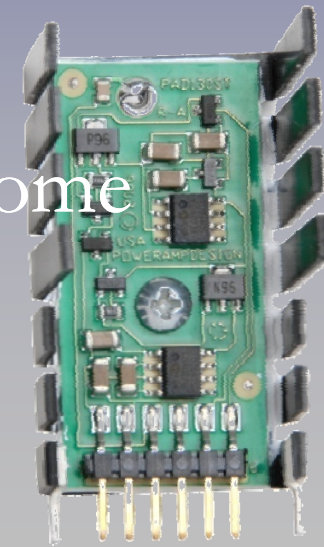
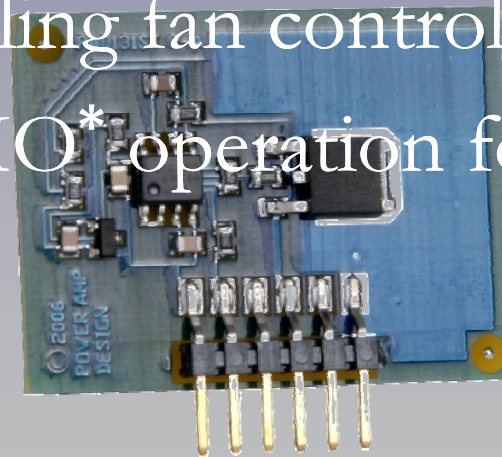
PAD Products Also Available on Custom Passive Heat Sinks for Special Applications



PAD amplifiers mounted on
passive heat sinks under **PAD**
custom designed motherboards

PAD Accessory Modules

- Optional accessory modules offer new features to amplifier models
- For example: model PAD125 offers programmable current limit features
- PAD131 offers cooling fan control
- PAD130 offers RRIO* operation for some models



* rail to rail input & output

PAD Evaluation Kits

- Most amplifier models offer dedicated evaluation kits for circuit development
- Evaluation kits are assembled and include all special components needed for the model
- Evaluation kits provide support for optional accessory modules



PAD Noted Customers

- General Electric
- NASA (Jet Propulsion Laboratory)
- General Motors
- Kodak
- Lockheed Martin
- NATO Undersea Research Centre
- Texas Instruments
- Schlumberger
- National Semiconductor

Conclusion

- **PAD** offers a full and expanding line of power operational amplifiers for industrial applications that offer superior electrical and thermal performance in a compact and plug-in design. PAD products are supported by expert application assistance, accessory modules, SPICE models, evaluation kits and our **PAD Power**[™] design spreadsheet.