



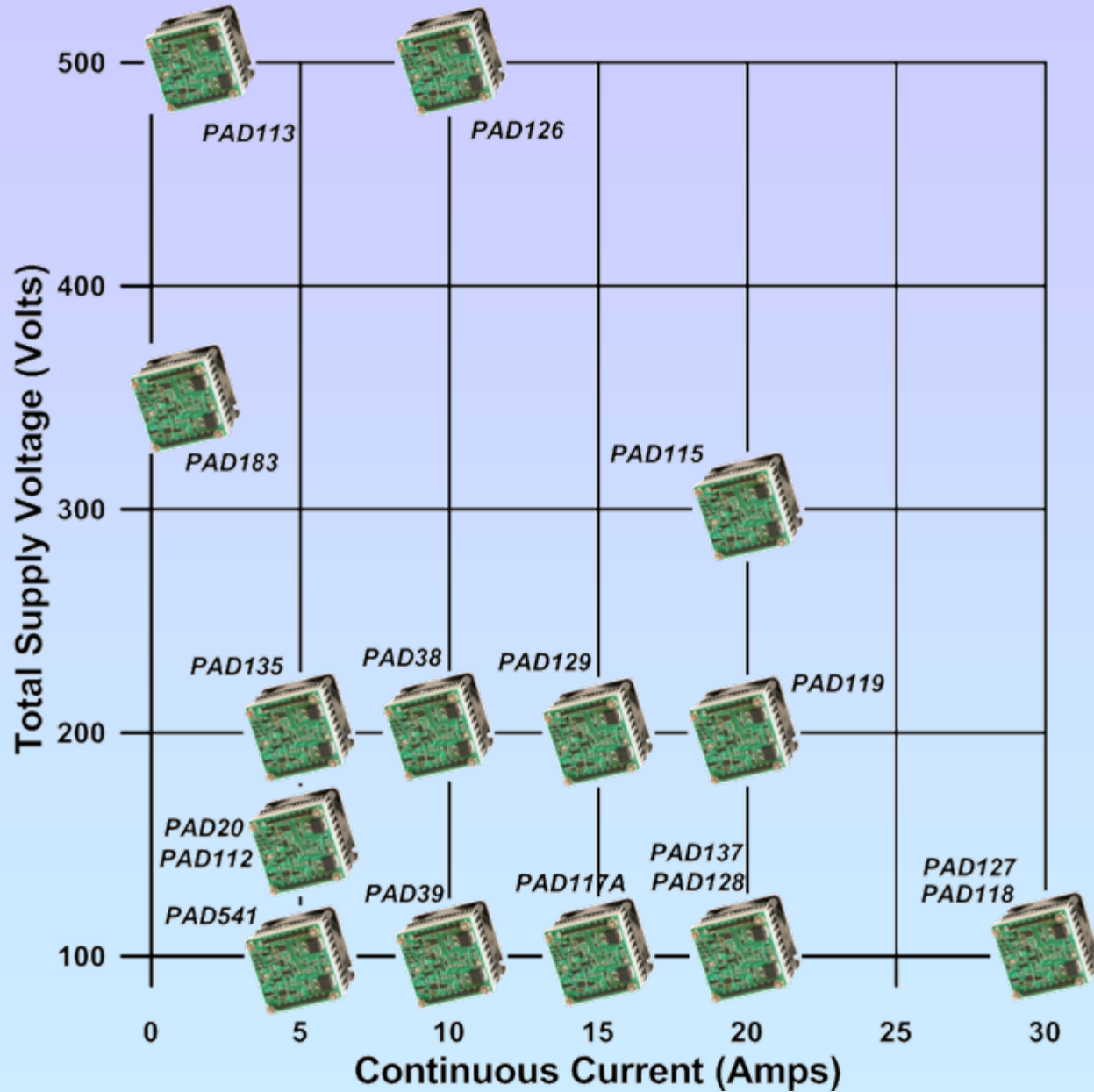
# ***PowerAmp Design***

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 500V, current ratings from 1.5A to 40A and a power dissipation range from 29W to 225W with footprints ranging from 40mm square to 80mm 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**<sup>™</sup>, 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

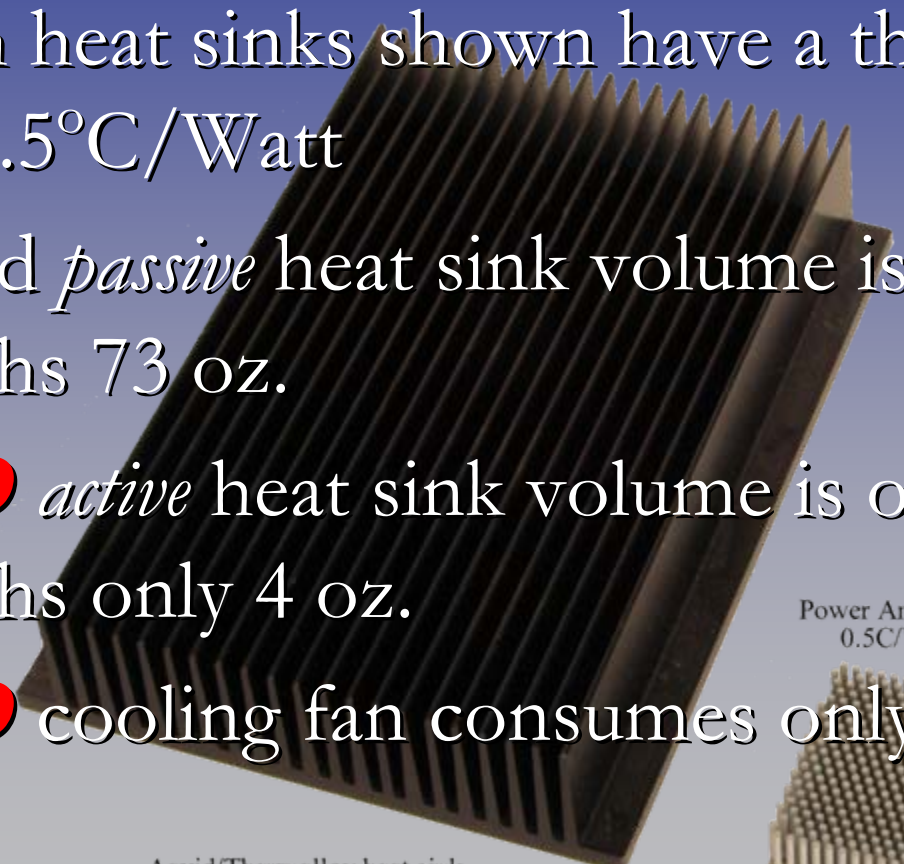
- **PAD** high power op amps offer a new concept: an integrated heat sink and fan optimize amplifier cooling while decreasing size and increasing power density
- **PAD** amplifiers are constructed with low cost surface mount technology on an insulated metal substrate and uses no beryllium oxide (BeO).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

# **PAD** Amplifier Advantages

- Compact plug-in design with integrated *active* 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
- Most amplifiers 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  $100\text{ in}^3$  and weighs 73 oz.
- **PAD** *active* heat sink volume is only  $4.6\text{ in}^3$  and weighs only 4 oz.
- **PAD** cooling fan consumes only 1.5 watts



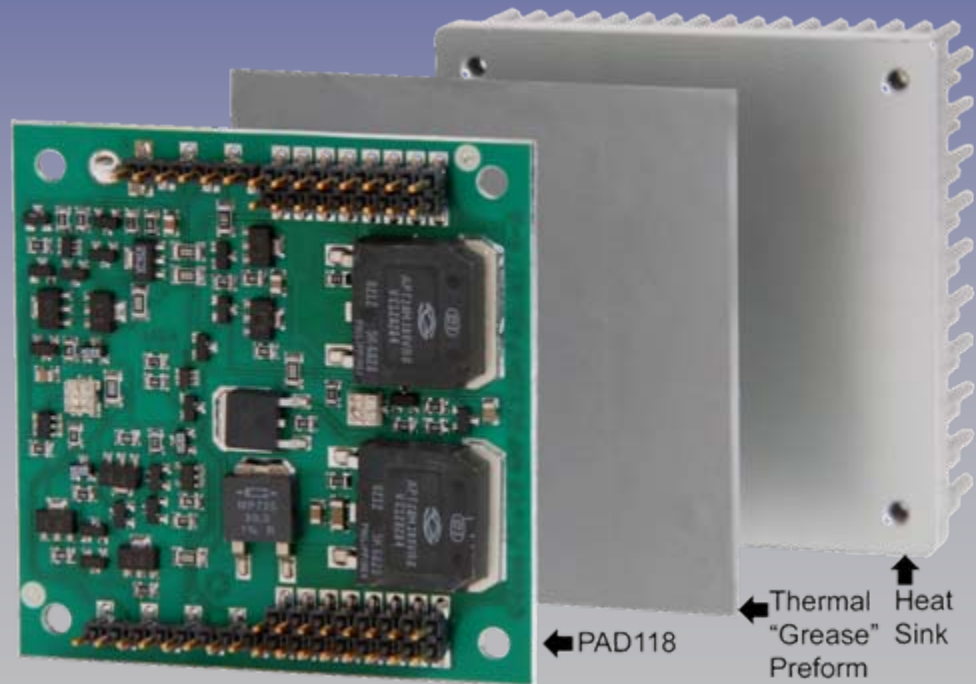
Aavid/Thermolloy heat sink  
 $0.5\text{C}/\text{Watt}$



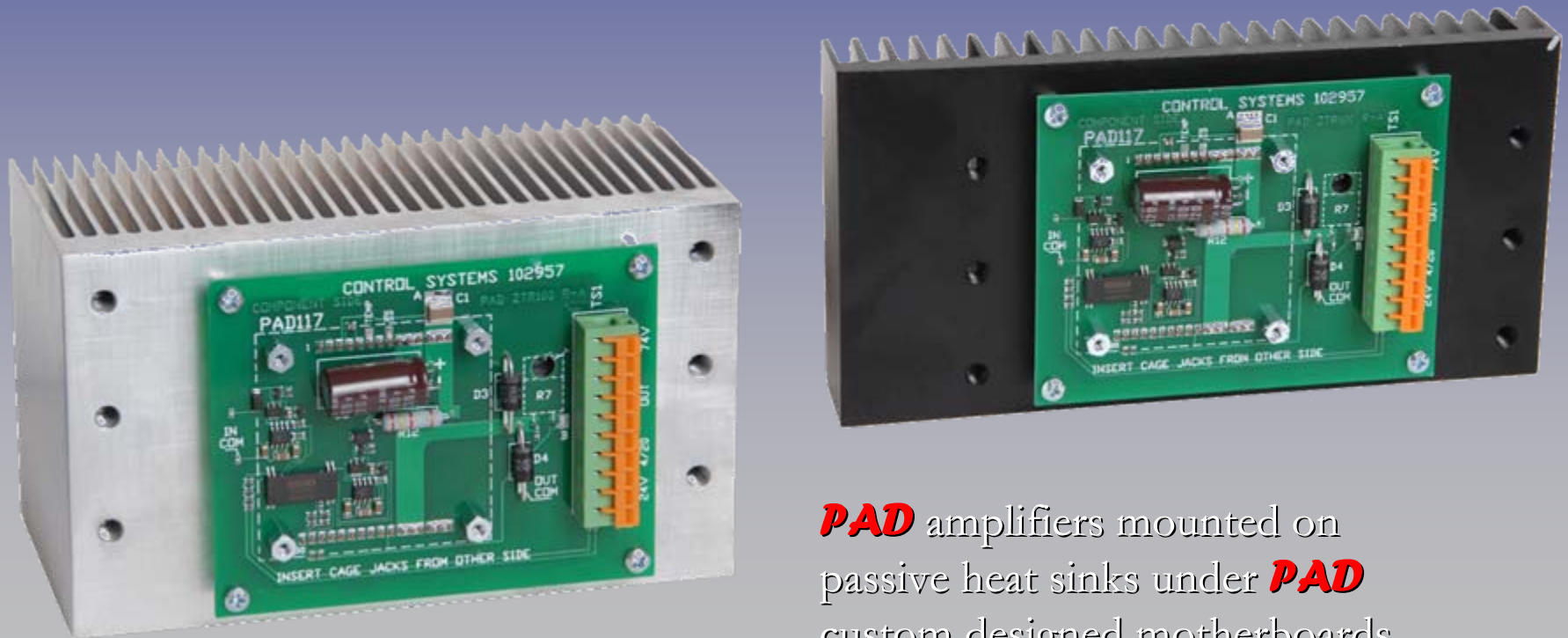
Power Amp Design heat sink  
 $0.5\text{C}/\text{Watt}$  (with fan)

# Amplifier Attachment

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



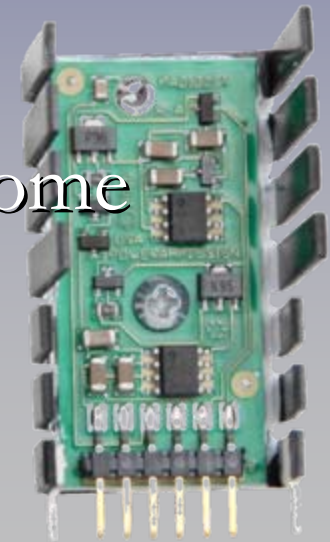
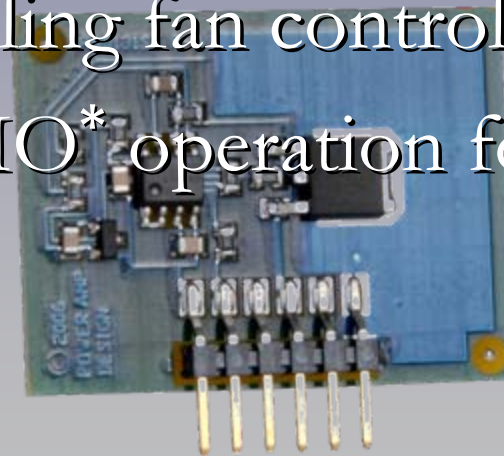
# **PAD** Products Also Available on Custom Passive Heat Sinks for Special Applications



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

# **PAD** Accessory Modules

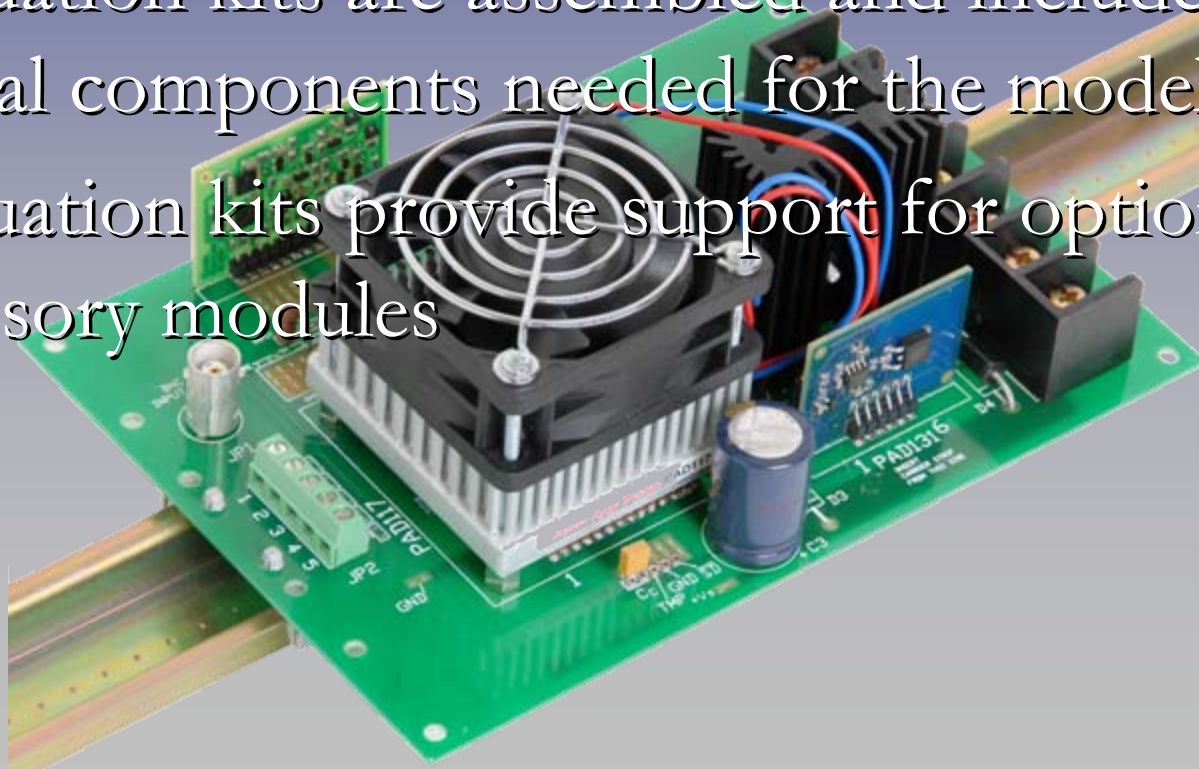
- Optional accessory modules offer new features to amplifier models
- For example: model PAD125 offers programmable current limit features
- PAD131 offers cooling fan control
- PAD130 offers RRIO\* operation for some models



\* 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
- Brookhaven National Laboratory
- Idaho National Laboratory
- NATO Undersea Research Centre
- Oyo Geospace
- Schlumberger
- Lawrence Livermore National Laboratory

# 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**<sup>™</sup> design spreadsheet.