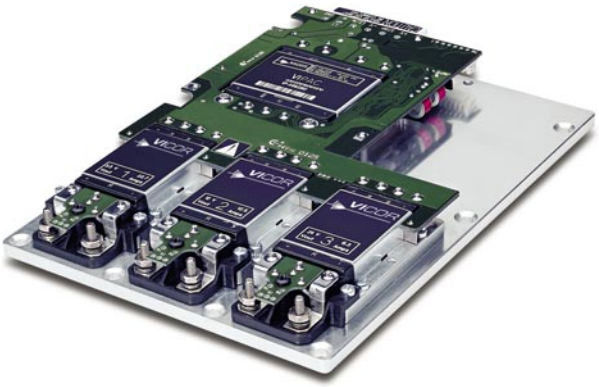
# DESIGN GUIDE

## VIPAC™



VICOR PowerBench

# Contents

| | |
|---|---|
| 2 – 3 | Product Overview |
| 4 | Features |
| 5 | Input / Output Options |
| 6 | Specifications |
| 7 – 8 | Technical Overview |
| 9 | Input Connections |
| 10 – 12 | Output Connection Options |
| 13 – 14 | Chassis Configurations |
| 15 – 16 | Mounting Options |
| 17 – 20 | Mechanical Drawings |
| 21 | Mechanical Information |
| 22 | Thermal Management |
| 23 | General Information |
| 24 | Application Tips |

# Product Overview

Vicor's VIPAC™ is an integrated power system leveraging the latest advances in DC-DC converter technology and modular front-ends. VIPAC combines application specific power processing units (PPU), a choice of chassis styles and remotely located hold up capacitors to provide fast, flexible and highly reliable power solutions for a wide range of demanding applications.

The PPU is the core element of the system and may be specified for 115/230 Vac operation. The PPU incorporates Vicor's autoranging FARM modular front-end to provide transient protection, EMI filtering and inrush current limiting. The web-based **PowerBench**™ enables designers to configure the PPU with up to three independently regulated outputs having power levels from 50 to 500 W and with as much as 900 W total output power. Vicor's Maxi, Mini, Micro Family DC-DC converters, in industry standard quarter, half and full brick packages, are used to deliver output voltages from 2 to 48 Vdc. Additionally, the wide trim range of the modules can provide operating voltages as low as 500 mV.

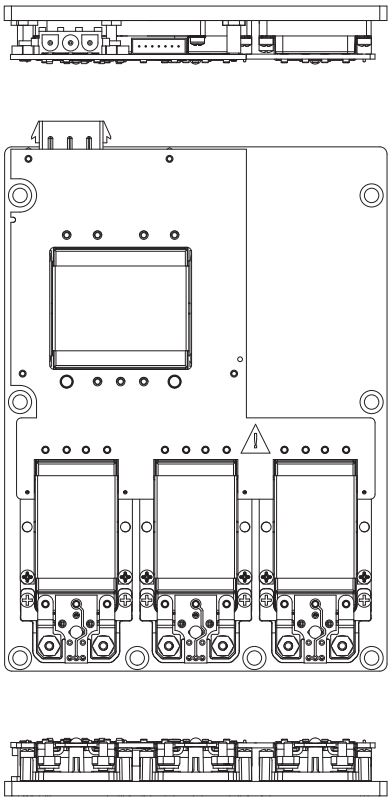
The PPU is comprised of:

- AC input modular front end
- Vicor's Maxi, Mini, Micro Family high density DC-DC converters
- Coldplate or finned chassis
- Choice of output termination styles

The VIPAC is offered in several chassis configurations facilitating its use in a variety of applications using either conduction, convection or forced convection cooling. The low profile, conduction cooled version may be mounted to an existing cabinet wall, coldplate or heat sink. The 0.5" or 1" finned versions, available in longitudinal or transverse configurations, are ideal for use in free or forced convection environments. The use of standard chassis footprints allows different input voltage configurations of the VIPAC to be used interchangeably depending on system and market requirements.

VIPACs use remotely located capacitors to facilitate packaging and placement options not previously available. The low profile PPU can be placed closer to the load or attached to cabinet walls while the capacitors may be integrated into the host system away from heat sources for improved reliability. System hold up / ride-thru requirements can also be tailored for specific applications via different value capacitors. The hold up capacitors may be obtained from Vicor as a prepackaged hold up box (HUB). VIPAC is a new class of flexible, high density power solutions.

**PPU**

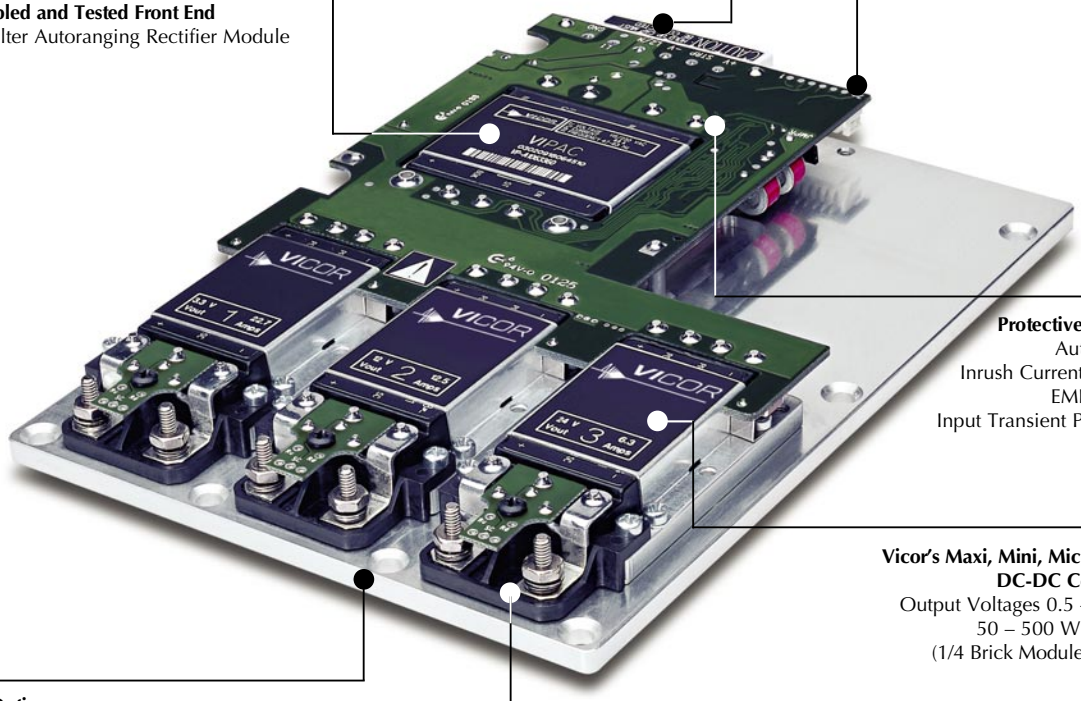


**HUB**

**Input**
115/230 Vac Autoranging

**I/O Interface**
Output Sequencing
BUS-OK
Output Enable / Disable

**Pre-assembled and Tested Front End**
FARM – Filter Autoranging Rectifier Module




**Protective Features**
Auto Restart
Inrush Current Limiting
EMI Filtering
Input Transient Protection

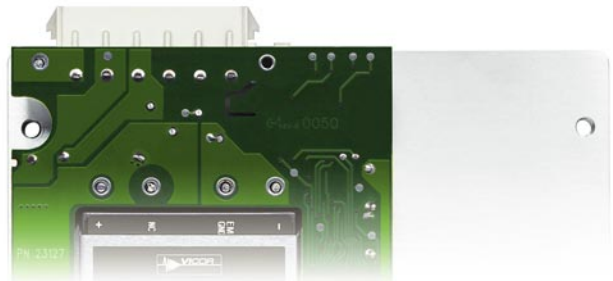
**Vicor's Maxi, Mini, Micro Family DC-DC Converters**
Output Voltages 0.5 – 48 Vdc
50 – 500 W / Output
(1/4 Brick Modules Shown)

**Platform Options**
Low Profile Coldplate
0.5" and 1" Optional Finned Configurations

**Choice of Output Termination**
(LugMate Shown)

## AC Input Autoranging

- 115/230 Vac
- 50/60 Hz (400 Hz optional)

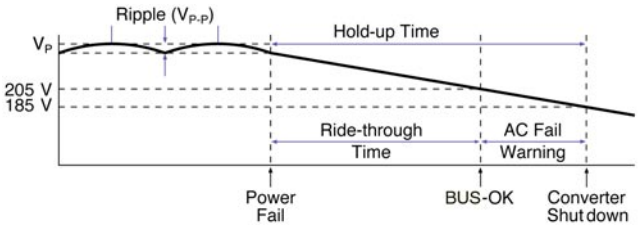


# FEATURES

- **Analog User Interface**

  Power Up / Down control

  BUS-OK




- **Partitioned Power Architecture**

  Maximizes packaging flexibility

  Remote hold-up capacitors (AC input)

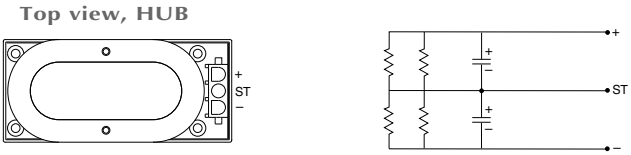
  User-definable hold-up characteristics (AC input)

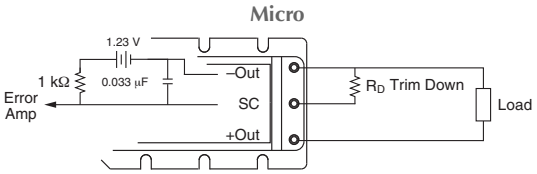
  Enhanced reliability

  Wide operating temperature range

  –20˚ to +95˚C chassis C–Grade

  –40˚ to +95˚C chassis T–Grade

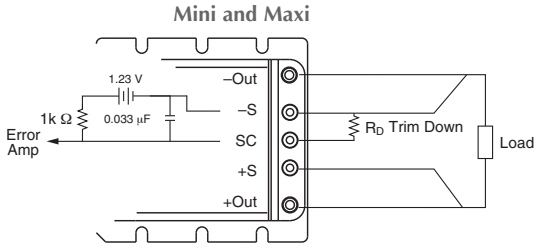



- **Secondary Control**

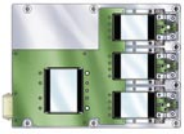
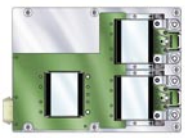
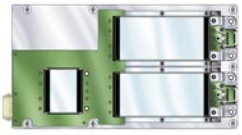
  Output voltage trimming

  10 – 110% Vout



# Output Options

Output Voltage Selection

| VIPAC Configuration | # Outputs | 2 V | 3.3 V | 5 V | 12 V | 15 V | 24 V | 28 V | 36 V | 48 V | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Micro | | | Maximum Output Power (W)* | | | | | | |
| VP-G | Single | 50 | 75 | 100 | 150 | 150 | 150 | 150 | 150 | 150 | **150** |
| VP-D | Single // | 100 | 150 | 200 | 300 | 300 | 300 | 300 | 300 | 300 | **300** |
| | Dual | 50<br>50 | 75<br>75 | 100<br>100 | 150<br>150 | 150<br>150 | 150<br>150 | 150<br>150 | 150<br>150 | 150<br>150 | **300** |
|  VP-A | Dual // | 100<br>50 | 150<br>75 | 200<br>100 | 300<br>150 | 300<br>150 | 300<br>150 | 300<br>150 | 300<br>150 | 300<br>150 | **450** |
| | Triple | 50<br>50<br>50 | 75<br>75<br>75 | 100<br>100<br>100 | 150<br>150<br>150 | 150<br>150<br>150 | 150<br>150<br>150 | 150<br>150<br>150 | 150<br>150<br>150 | 150<br>150<br>150 | **450** |
| | # Outputs | Mini | | | Maximum Output Power (W)* | | | | | | |
| VP-E | Single | 100 | 150 | 200 | 250 | 250 | 250 | 250 | 250 | 250 | **250** |
|  VP-B | Single // | 200 | 300 | 400 | 500 | 500 | 500 | 500 | 500 | 500 | **500** |
| | Dual | 100<br>100 | 150<br>150 | 200<br>200 | 250<br>250 | 250<br>250 | 250<br>250 | 250<br>250 | 250<br>250 | 250<br>250 | **500** |
| | # Outputs | Maxi | | | Maximum Output Power (W)* | | | | | | |
| VP-F | Single | 160 | 264 | 400 | 500 | 500 | 500 | 500 | 500 | 500 | **500** |
|  VP-C | Single // | 320 | 528 | 800 | 900 | 900 | 900 | 900 | 900 | 900 | **900** |
| | Dual | 160<br>160 | 264<br>264 | 400<br>400 | 500<br>500 | 500<br>500 | 500<br>500 | 500<br>500 | 500<br>500 | 500<br>500 | **900** |

*Model numbers and total output power capability are application specific.
Component tolerances may effect total output power (±5%) in parallel (//) configurations.
See VIPAC configuration tool at: [vicorpower.com/vcad](vicorpower.com/vcad)

# SPECIFICATIONS

### 115/230 Vac Autoranging Input

| Parameter | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|
| Operating input voltage | 90 | | 132 | Vac | Autoranging doubler mode |
| | 180 | | 264 | Vac | Autoranging bridge mode |
| Input undervoltage shut down | | | 90 | Vac | No damage |
| AC line frequency | 47 | | 63 | Hz | C-Grade |
| | 47 | | 440 | Hz | T-Grade |
| Power factor | | 0.60 | | | Nominal Line |
| Inrush current | | | 30 | Amps | 264 Vac peak line, cold start |
| Input surge withstand Performance Criteria B | EN61000-4-5 | | | | 2 kV–50 µs common mode<br>1 kV–50 µs differential mode |
| Hold-up capacitance | | 1,800 | 3,300 | µF | Refer to VCAD calculator |
| Leakage current | | | 3.2 | mA | at 264 Vac input |
| EMI | | | | | Additional filter components are required for compliance to EN55022 and FCC conducted emissions requirements. |

### Environmental

| Parameter | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|
| Dielectric withstand | 2,121 | | | Vdc | Vdc test recommended due to Y-caps |
| Input to chassis | 1,500 | | | Vrms | Class 1 product. Isolation components tested prior to assembly. Do not test finished product at this value. |
| Input to output | 3,000 | | | Vrms | |
| Operating temperature – chassis | | | | | |
| C-Grade | -20 | | 95 | °C | |
| T-Grade | -40 | | 95 | °C | |
| Shock | 50 | | | g | GR 6063, NEBS, Zone 4 (designed to meet) |
| Vibration | 1 | | | g | GR 6063, NEBS, Zone 4 (designed to meet) |
| Humidity | 5 | | 95 | % | Non-condensing |
| Safety approvals<br>cTÜVus EN 60950-1,<br>UL 60950-1,<br>CE Marked (LVD) | | | | | |

### Output Specifications – General at 25°C, nominal line and nominal load, per module unless otherwise specified

| Parameter | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|
| Output voltage set point | | | ±1 | % | Vout nom |
| Line regulation | | ±0.02 | ±0.2 | % | Low line to high line; full load |
| Temperature regulation | | ±0.002 | ±0.005 | %/°C | Over operating temp. range |
| Over temperature shut down | | 115 | | °C | |
| Power sharing accuracy | | ±2 | ±5 | % | 10% to 100% of full load |
| Programming range | 10 | | 110 | % | Of nominal output voltage.<br>(For trimming below 90% of nominal, a minimum load of 10% of maximum rated power may be required) |
| Current limit | | 115 | | % Iout max. | Output voltage 95% of nominal |
| Short circuit current | | 115 | | % Iout max. | Output voltage <250 mV |

***See 300 V Maxi, Mini, Micro Family data sheets for detailed module specifications.***

### Interface Control Functions (See technical description)

| Type | Output Enable / Disable | Output Sequencing | Bus OK |
|---|---|---|---|
| Remote | ✔ | ✔ | ✔ |

# TECHNICAL OVERVIEW

## Overview

Vicor's VIPAC offers a 115/230 Vac autoranging input. The front-end section utilizes Vicor's FARM input module to provide EMI filtering, transient protection, inrush current limiting and rectification. The VIPAC has provisions to allow controlling the operation of the individual outputs and providing a BUS OK status indication. Reference the figure below for circuit operation.

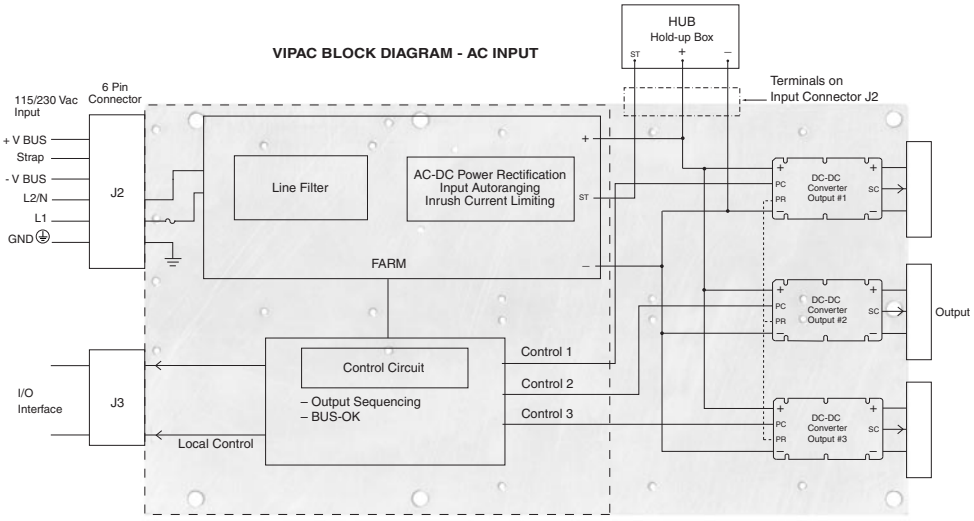
Up to three individually fused Maxi, Mini, Micro Family DC-DC converters are combined with the front end in an integrated mechanical – assembly providing a high efficiency power supply delivering up to 900 W of output power.

## Circuit Operation

The AC autoranging input VIPAC utilizes the FARM module which provides inrush current limiting, transient protection, EMI filtering and rectification. The AC line voltage is applied via an agency approved 6 pin connector. A fuse in the "L1" lead protects the VIPAC from damage due to internal shorts. At start-up, AC inrush current is limited by a PTC thermistor. The PTC thermistor serves as both an inrush current limiter on power up and a current limiting shut-down device in the event of an input over voltage condition. The PTC is shunted out shortly after initial power up by a DC bus voltage sense circuit. The main energy storage capacitors are located remotely in the HUB (Hold-up Box) or as customer supplied hold-up capacitors. The main rectifiers and filter capacitors act as either a full wave bridge or voltage doubler (depending on the applied AC voltage) delivering a nominal 300 Vdc to one or more Vicor Maxi, Mini, Micro Family DC-DC converters.

The DC-DC converters deliver the selected output voltage and current levels, provide output over voltage protection, output current limiting, voltage regulation, trim capability and input to output isolation.

At initial power up, the front end is configured for 230 Vac operation and the PTC inrush limiter permits the main storage capacitors to charge up at a controlled rate toward full operating DC bus potential. If the bus voltage settles below the operating threshold, the unit will auto-strap for 115 Vac operation. The strapping function is performed by an SCR that configures the front end as either a full wave bridge or a voltage doubler. If the unit is operating in the 115 Vac mode and a long duration transient is applied to the VIPAC (>150 Vac for 50 ms), the unit will auto-strap for 230 Vac operation. Input power must be removed for approximately one minute to restore normal operation from 115 Vac. A control circuit holds the DC-DC converter PC pins low, DC outputs off, the PTC shunt inactive and the BUS-OK output in FAIL status until the DC bus potential reaches a minimum threshold. The PC terminals of all converter modules internal to the VIPAC are FET controlled by a logical replica of the BUS-OK status line, and therefore inhibit converter operation at power up until the DC bus potential has settled to a proper operating level. At this point, the converters are enabled and the PTC shunt activated. A voltage sensing circuit connected across the DC bus performs input over voltage sensing and protection. In the event of an over voltage condition, an SCR/PTC combination will simultaneously disable the DC-DC converters and hold down the DC bus. Normal operation will resume when the input voltage returns within steady-state limits.



**BUS-OK**

An internal replica of BUS-OK is wired to the PC pin of all internal driver modules. The modules will be disabled (no DC output) during initial power up of the VIPAC until the internal DC input bus voltage to the DC-DC converters is sufficient to support fully-loaded operation. The BUS-OK status output reflects the status of this inhibit function. This same logic circuit will shut down the converters when the internal DC bus voltage is insufficient to support proper loaded operation. This shut down will occur during normal power down, line dropouts of duration exceeding the hold up time, or internal faults causing the internal DC bus voltage at the input of the converters to collapse. The BUS-OK output provide the user with an optically isolated status indication of the internal DC bus. This output, in system applications, can provide power supply status, switch in (standby) backup sources or initiate "power down" sequences to save volatile memory contents in the event of a power loss.

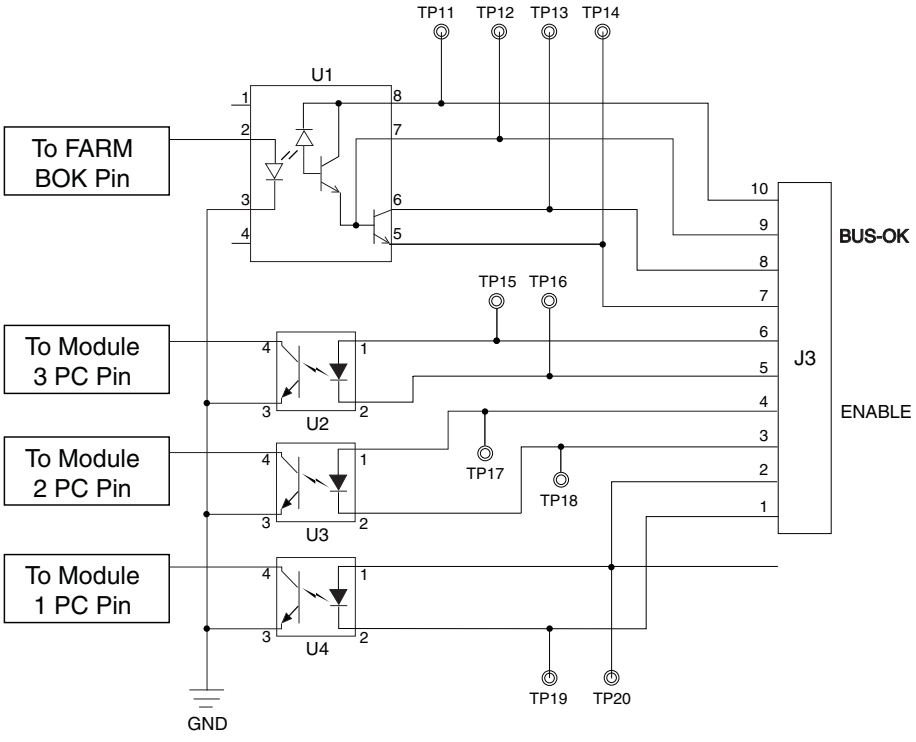
**Individual Module Control**

Driving the appropriate optocoupler can independently control each DC-DC module within the VIPAC. The minimum optocoupler input current for disabling the supplies is 3 mA. The maximum allowable current is 20 mA. J3 connector pins 1 and 2 always control module 1, pins 3 and 4 always control module 2 (if present) and pins 5 and 6 control module 3 (if present).

**Electrical Connections**

J3 status output pair BUS-OK+ (PIN 8), BUS-OK– (PIN 7) are the collector (+) and emitter (–) of NPN optocoupler output transistor. The collector terminal BUS-OK+ of the optocoupler, in a typical application, and the drive pin (PIN 10) can be connected via current limiting resistors to an external source no greater than 18 Vdc. These resistors should limit the maximum current to the optocoupler output transistors to 2 mA. The emitter terminal BUS-OK– is connected to the return of the external source.

The status FAULT condition will set the BUS OK optocoupler output transistors in saturation and are capable of sinking up to 1.5 mA with a Vce saturation voltage of 0.4 V. Users should be cautioned that although the output of the VIPAC can be used as the pull up source, shortly after BUS-OK changes from OK (High Z) to NOT OK (Saturated), the pull up voltage will be shut down. It is thus advisable to provide a capacitive reservoir, if the pull up source is one of the VIPAC's outputs, in order to maintain the pull up potential after loss of DC current output. Use edge sensing logic to detect assertion of logic outputs, or a separate source of bias supply voltage (i.e., backup batteries) to provide a safe pull up voltage source regardless of the line status.



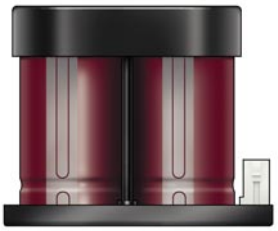
# Input Connections

## AC Input/V Bus

| Conn. | Pin # | Funct. | Mating Conn. |
|---|---|---|---|
| J2 | 1 | V Bus+ | P/N 22499 |
| | 2 | Strap | |
| | 3 | V Bus– | |
| | 4 | L2/N | |
| | 5 | L1 | |
| | 6 | GND ⏚ | |

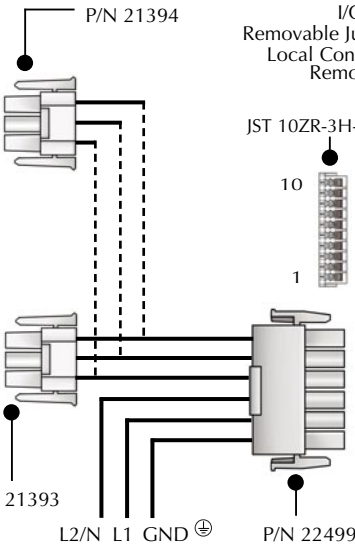
## I/O Interface*

| Conn. | Pin # | Funct. | Mating Conn. |
|---|---|---|---|
| J3 | 1 | Module 1 E/D Return | JST 10ZR-3H-P |
| | 2 | Module 1 E/D Supply | |
| | 3 | Module 2 E/D Return | |
| | 4 | Module 2 E/D Supply | |
| | 5 | Module 3 E/D Return | |
| | 6 | Module 3 E/D Supply | |
| | 7 | BUS-OK Status Return | |
| | 8 | BUS-OK Status Supply | |
| | 9 | N/C | |
| | 10 | BUS-OK Drive Input | |



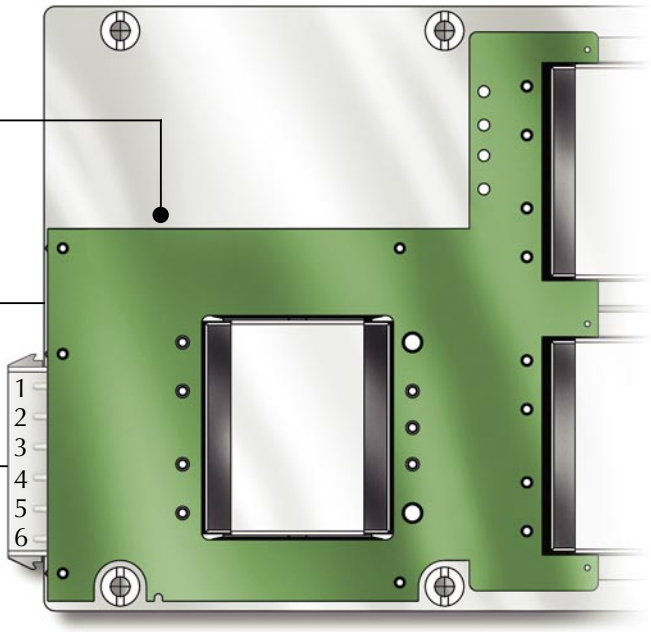
HUB 2200-s
2700-s
3300-s

HUB 820-s
1200-s
1800-s




Maximum cable length between the HUB and VIPAC 3'

### 115/230 Vac Autoranging



# Output Connection Options

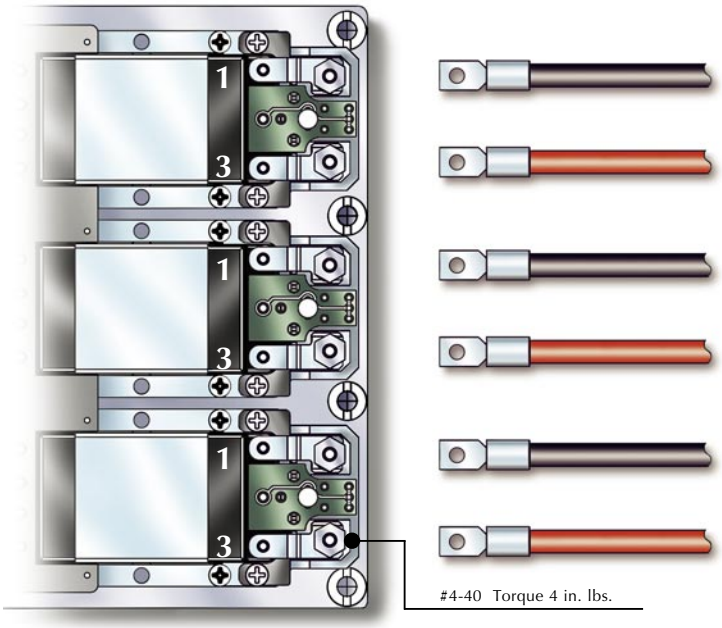
## Discrete Output Configurations

**LugMate** (Factory Installed Option)

**Ring Lugs**

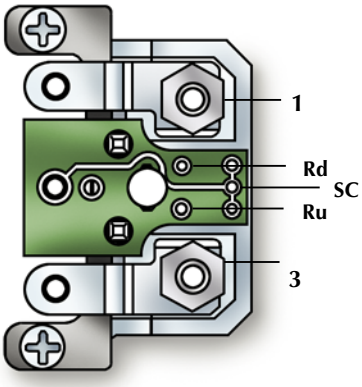
**LugMate Pin Out**

### Micro LugMate

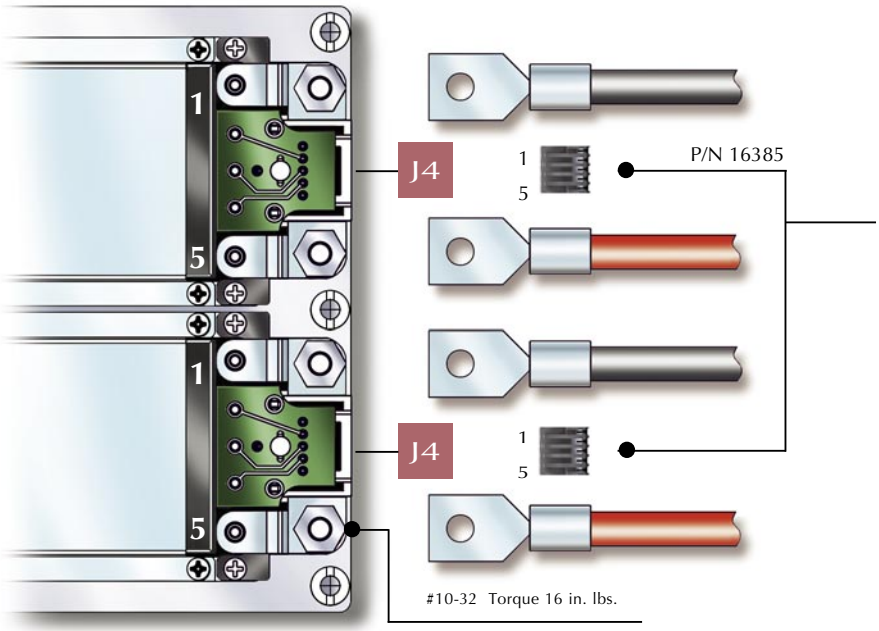



| Pin # | Solder Pad | Function |
|---|---|---|
| 1 | | – Vout |
| | Rd | Trim-Down |
| | SC | Secondary Control |
| | Ru | Trim-Up |
| 3 | | + Vout |

**Micro LugMate** - with Rd/Ru trim resistor solder pads. (Design calculator for trim resistors located at vicorpower.com)




### Mini/Maxi LugMate




| Pin # | Conn. | Function | Mating Conn. |
|---|---|---|---|
| 1 | | – Vout | |
| | J4-1 | – Vout *Removable Jumper | P/N 16385 |
| | J4-2 | – Sense *Removable Jumper | |
| | J4-3 | Secondary Control | |
| | J4-4 | + Sense *Removable Jumper | |
| | J4-5 | + Vout *Removable Jumper | |
| 5 | | + Vout | |

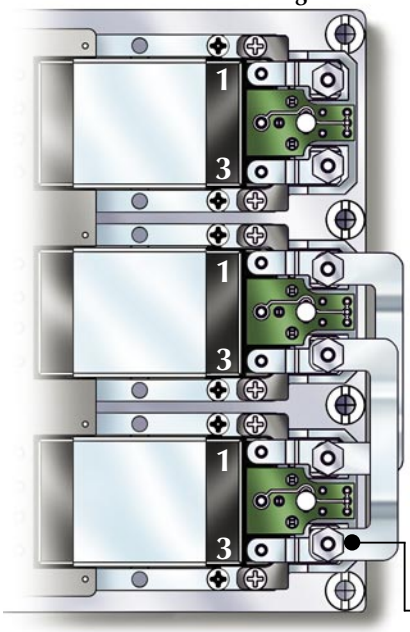
*Removable jumper is factory installed for local sensing. See Pg 24 for details

# Output Connection Options

**Parallel Output Configurations** Shown with the output of two modules connected in parallel using BUS BARS.

**LugMate** (Factory Installed Option)

**Micro LugMate**

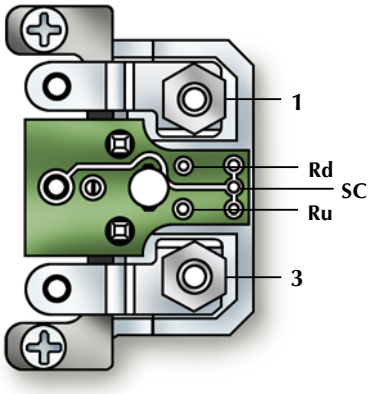



**Ring Lugs**

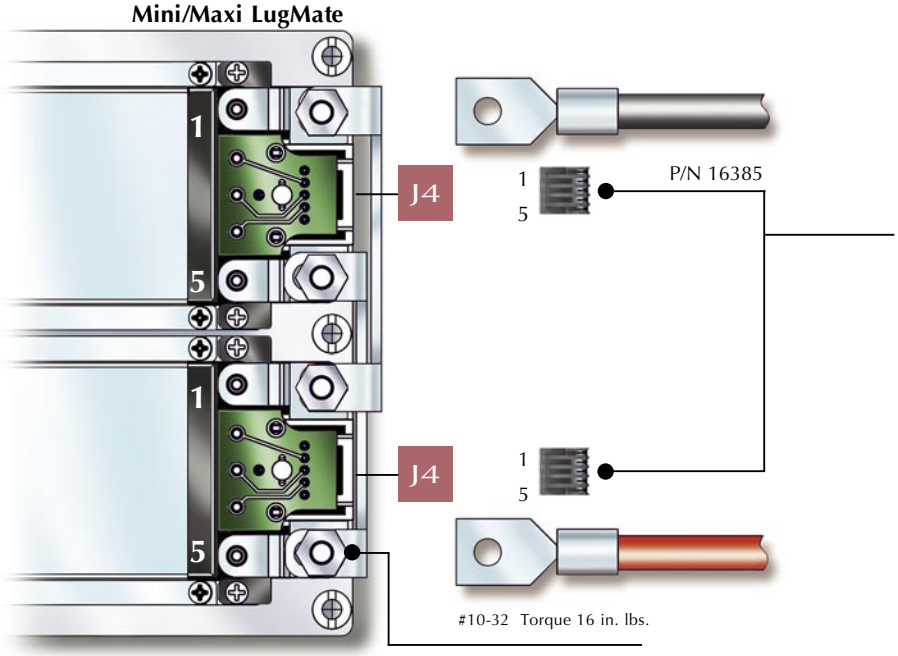
**LugMate Pin Out**

| Pin # | Solder Pad | Function |
|---|---|---|
| 1 | | – Vout |
| | Rd | Trim-Down |
| | SC | Secondary Control |
| | Ru | Trim-Up |
| 3 | | + Vout |

Micro LugMate - with Rd/Ru trim resistor solder pads. (Design calculator for trim resistors located at vicorpower.com)




**Mini/Maxi LugMate**



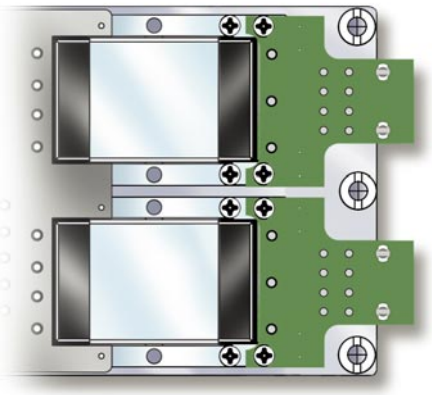

| Pin # | Conn. | Function | | Mating Conn. |
|---|---|---|---|---|
| 1 | | – Vout | | |
| | J4-1 | – Vout | *Removable Jumper | P/N 16385 |
| | J4-2 | – Sense | | |
| | J4-3 | Secondary Control | | |
| | J4-4 | + Sense | *Removable Jumper | |
| | J4-5 | + Vout | | |
| 5 | | + Vout | | |

*Removable jumper is factory installed for local sensing. In using 2 modules configured as a single output as illustrated, one module must be dedicated as a master, or the sense lines must be terminated to the same point physically to their respective output.

# Output Connection Options

## PlugMate
(Factory Installed Option)

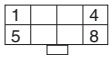
### Micro PlugMate



### Mating Connector Kits

Vicor kit P/N 25073

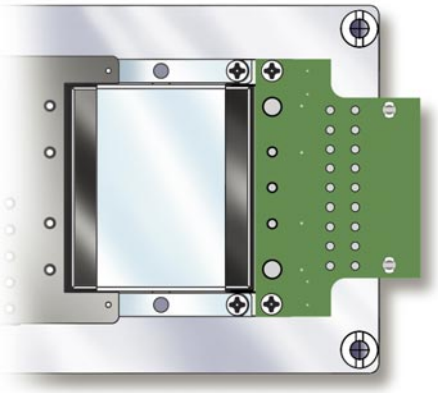
### PlugMate Pin Out
(Looking into PlugMate)



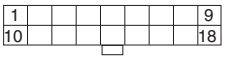

| Pin # | Function | Pin # | Function |
|---|---|---|---|
| 1 | +Vout | 5 | +Vout |
| 2 | +Vout | 6 | N/C |
| 3 | –Vout | 7 | SC |
| 4 | –Vout | 8 | –Vout |

| Mating Connector | TE Connectivity P/N | Vicor P/N |
|---|---|---|
| Housing | TYC-794657-8 | |
| Pin | 1-106529-2 | |
| Kit | | 25073 |

### Mini PlugMate



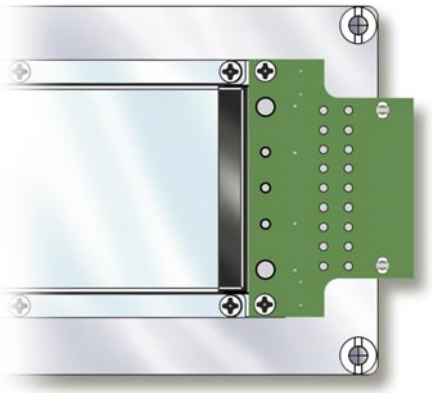
Vicor kit P/N 25067



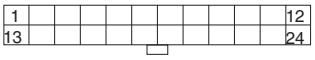

| Pin # | Function | Pin # | Function |
|---|---|---|---|
| 1 | +Vout | 10 | +Vout |
| 2 | +Vout | 11 | +Vout |
| 3 | +Vout | 12 | +Vout |
| 4 | N/C | 13 | +S |
| 5 | N/C | 14 | SC |
| 6 | N/C | 15 | –S |
| 7 | –Vout | 16 | –Vout |
| 8 | –Vout | 17 | –Vout |
| 9 | –Vout | 18 | –Vout |

| Mating Connector | TE Connectivity P/N | Vicor P/N |
|---|---|---|
| Housing | TYC1-794657-8 | |
| Pin | 1-106529-2 | |
| Kit | | 25067 |

### Maxi PlugMate



Vicor kit P/N 25061



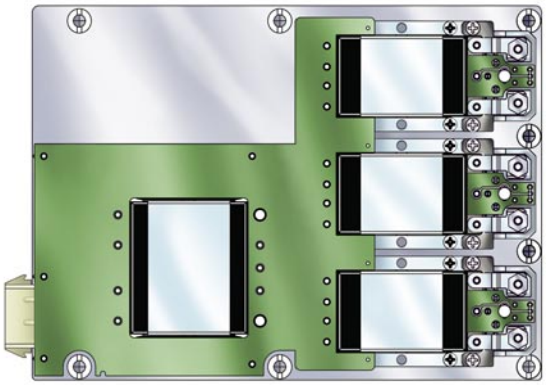

| Pin # | Function | Pin # | Function |
|---|---|---|---|
| 1 | +Vout | 13 | +Vout |
| 2 | +Vout | 14 | +Vout |
| 3 | +Vout | 15 | +Vout |
| 4 | +Vout | 16 | +Vout |
| 5 | +Vout | 17 | +Vout |
| 6 | N/C | 18 | +S |
| 7 | SC | 19 | –S |
| 8 | –Vout | 20 | –Vout |
| 9 | –Vout | 21 | –Vout |
| 10 | –Vout | 22 | –Vout |
| 11 | –Vout | 23 | –Vout |
| 12 | –Vout | 24 | –Vout |

| Mating Connector | TE Connectivity P/N | Vicor P/N |
|---|---|---|
| Housing | TYC2-794657-4 | |
| Pin | 1-106529-2 | |
| Kit | | 25061 |

**Note:**

*VIPACs that contain multiple modules configured as a single output (paralleled for power or redundancy) MUST have their Outputs and Sense connected to each other at the load.* **DO NOT OPERATE A PARALLEL CONFIGURATION WITH ONLY ONE MODULE CONNECTED.**

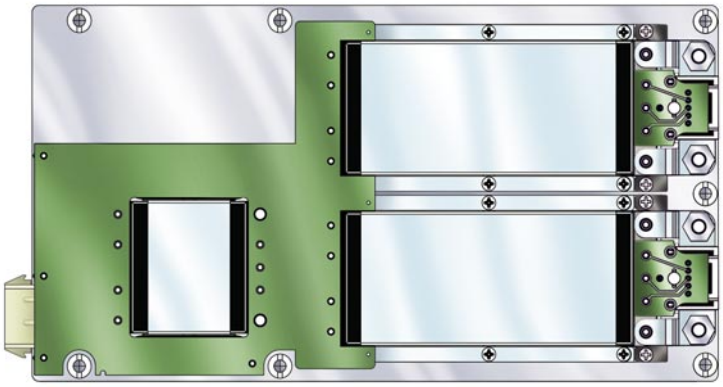
# Chassis Configurations



**VP-A**

**3 MICRO**

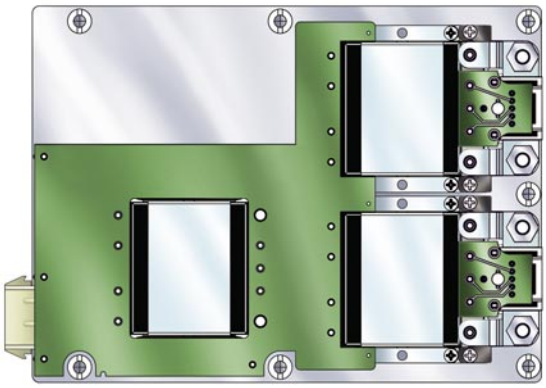
- 4.96" x 6.8" (126,0 x 172,7 mm)
- Dual or Triple Output
- Up to 450 W
- Up to 75 A



**VP-C**

**2 MAXI**

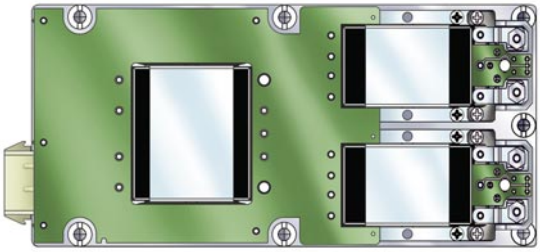
- 4.96" x 9.15" (126,0 x 232,4 mm)
- Single or Dual Output
- Up to 900 W
- Up to 160 A



**VP-B**

**2 MINI**

- 4.96" x 6.8" (126,0 x 172,7 mm)
- Single or Dual Output
- Up to 500 W
- Up to 100 A

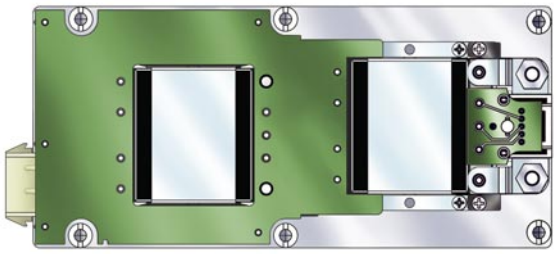


**VP-D**

**2 MICRO**

- 3.15" x 6.8" (80,0 x 172,7 mm)
- Single or Dual Output
- Up to 300 W
- Up to 50 A

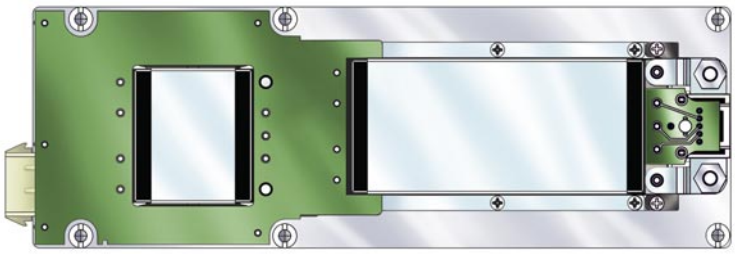
# Chassis Configurations



**VP-E**

**1 MINI**

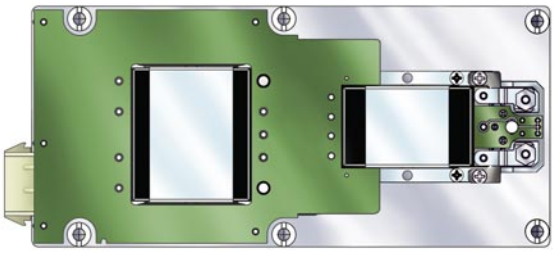
- 3.15" x 6.8" (80,0 x 172,7 mm)
- Single Output
- Up to 250 W



**VP-F**

**1 MAXI**

- 3.15" x 9.15" (80,0 x 232,4 mm)
- Single Output
- Up to 500 W
- Up to 80 A

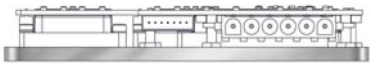


**VP-G**

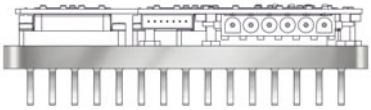
**1 MICRO**

- 3.15" x 6.8" (80,0 x 172,7 mm)
- Single Output
- Up to 150 W
- Up to 25 A

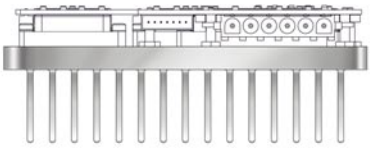
**Finned Chassis Configurations**



Coldplate

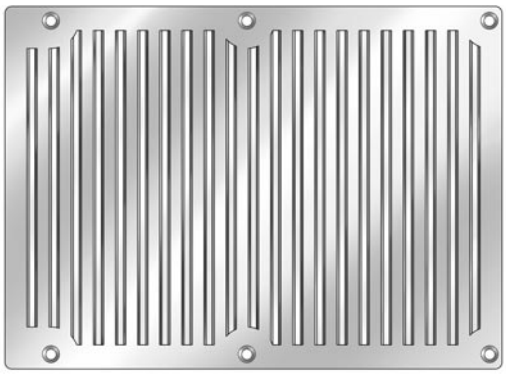


Optional 0.5" Fin



Optional 1" Fin

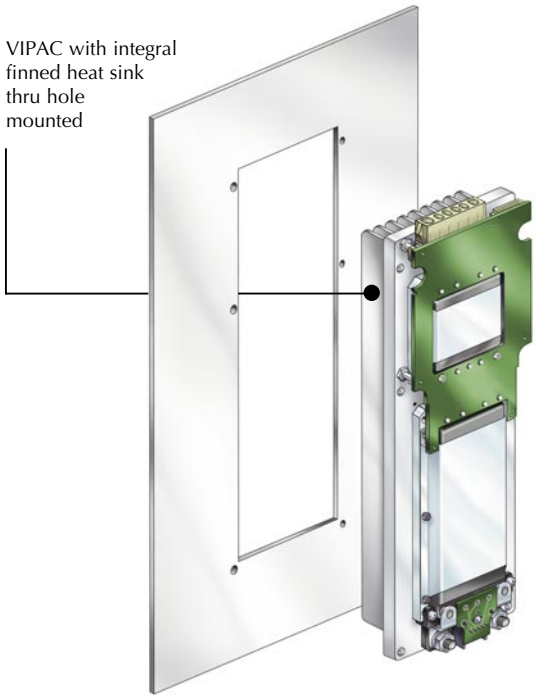
Longitudinal



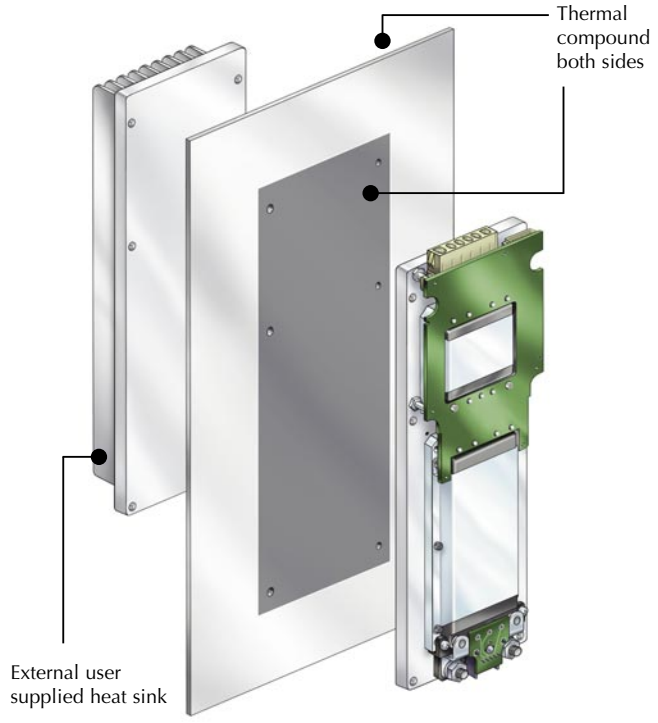
Transverse

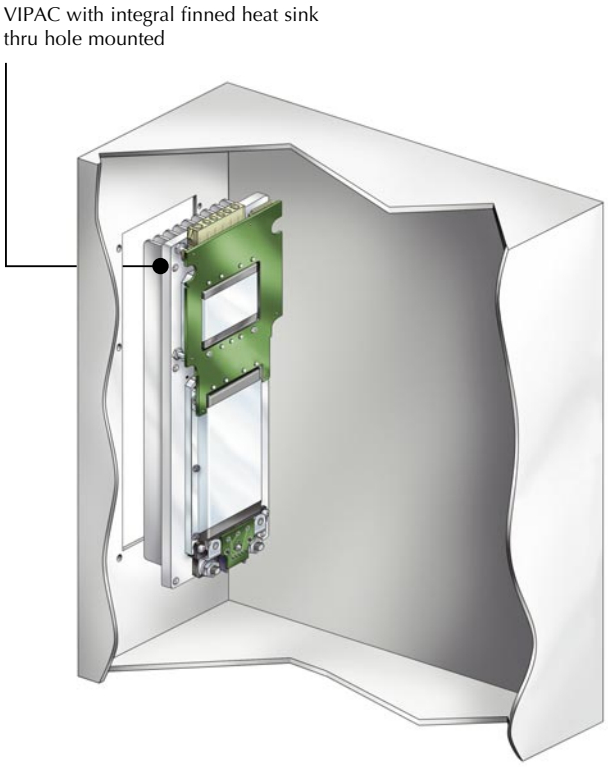
# Mounting Options

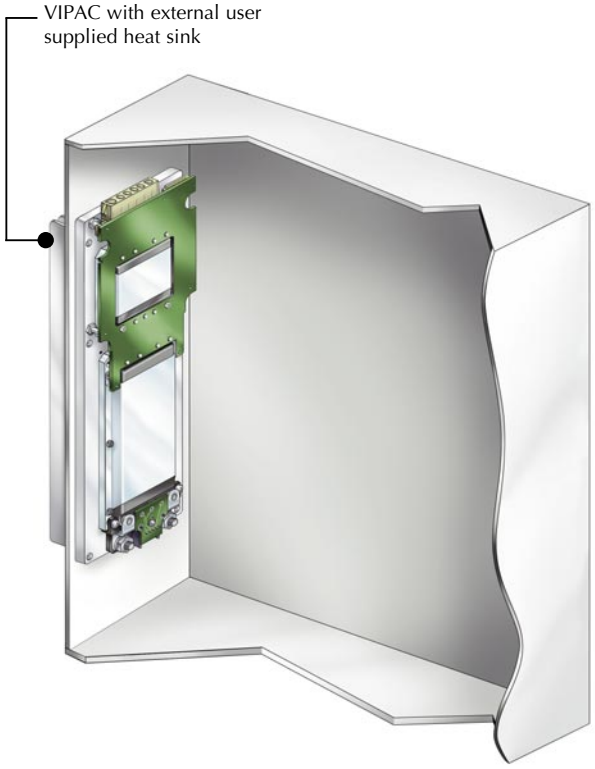
### Thru Hole Mounting



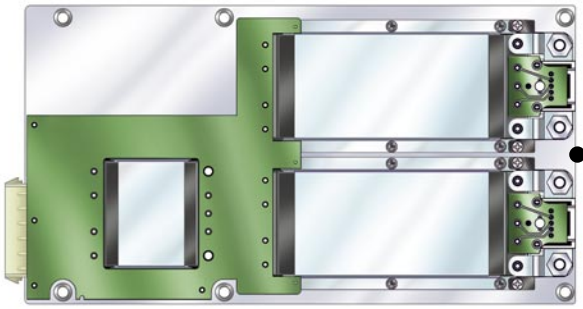

### Surface Mounting



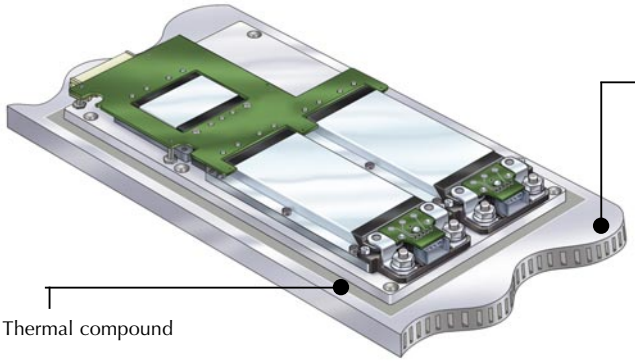



# Mounting Options

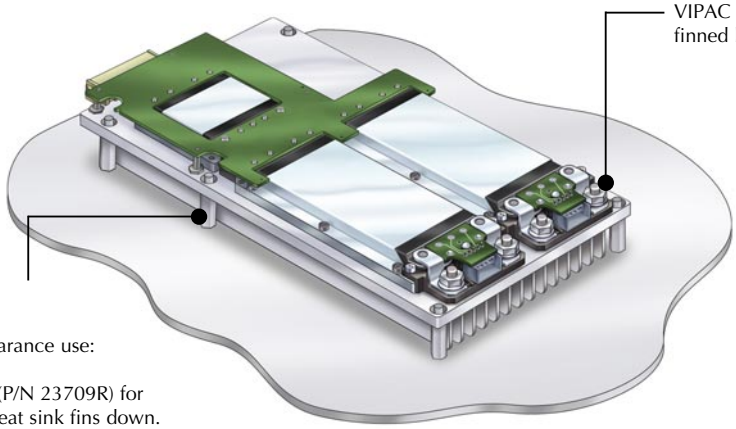


Coldplate VIPAC



Coldplate VIPAC mounted
to custom thermal interface

Thermal compound



VIPAC with integral
finned heat sink (down)

For proper clearance use:

Long standoff (P/N 23709R) for
mounting 1" heat sink fins down.

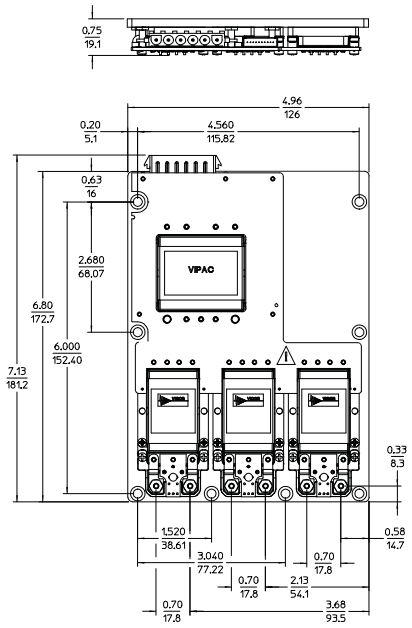
Short standoff (P/N 23710R) for mounting
0.5" heat sink fins down
or either heat sink fins up.

VIPAC with integral
finned heat sink (up)

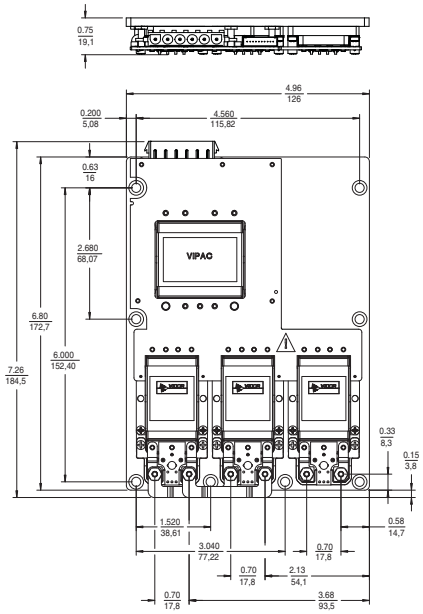
# MECHANICAL DRAWINGS

## Configuration VP-A

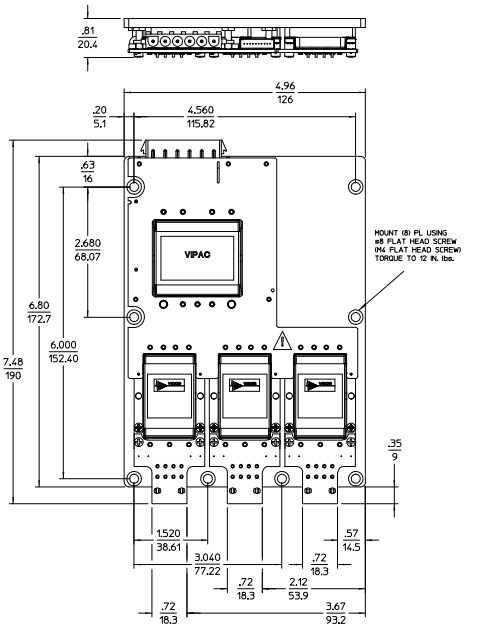
### LugMates




### LugMates/Bus Bars

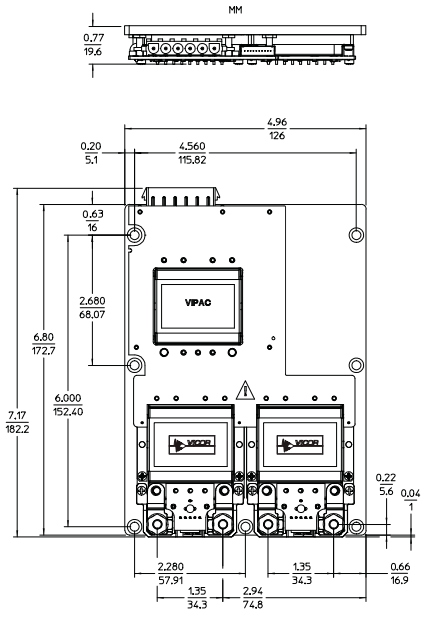



### PlugMates

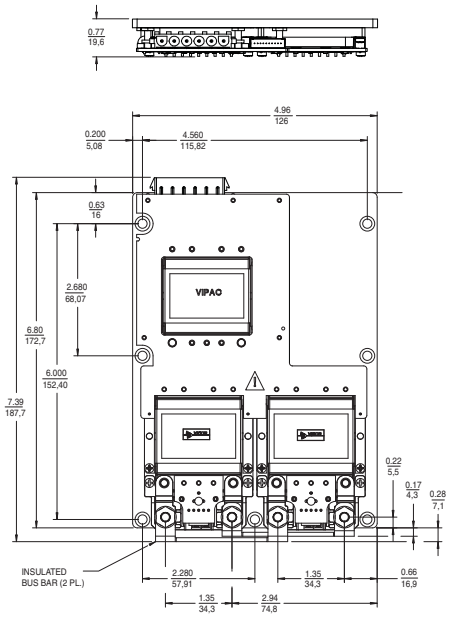



## Configuration VP-B

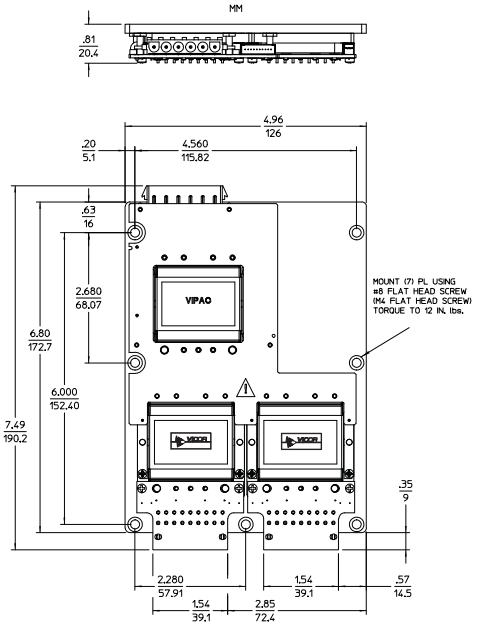
### LugMates




### LugMates/Bus Bars




### PlugMates



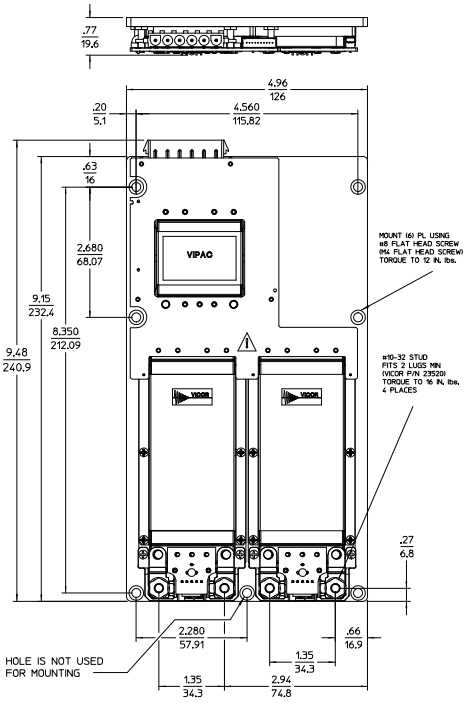

| Torque in. / lbs. | Feature | MOUNTING | | | Max. Chassis Temp. |
|---|---|---|---|---|---|
| | | Locations indicated by | Type | Quantity of holes provided for VIPAC Model Configuration | |
| | Coldplate (Thermal interface material required) | ◎ ◉ | Clearance holes for 8-32 90 CS to .30 | VP - 6 A 6 B 5 C 6 D 6 E 6 F 6 G | 95°C |
| 12 | Finned heat sink | ◎ | threaded thru hole for 8-32 | VP - 6 A 6 B 5 C 6 D 6 E 6 F 6 G | 95°C |
| 4<br>16 | Micro Lugmate<br>Mini/Maxi Lugmates | | | | |

All dimensions are $\frac{\text{in}}{\text{mm}}$

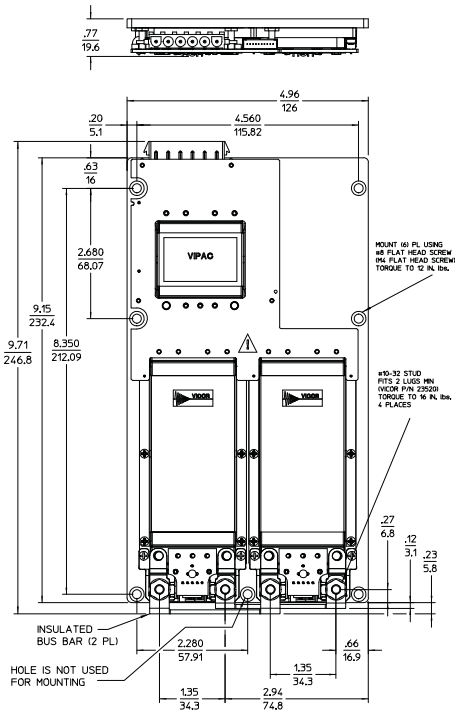
# MECHANICAL DRAWINGS

## Configuration VP-C

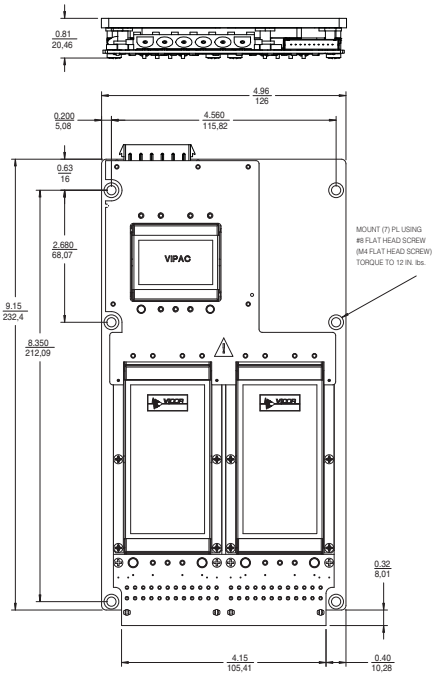
### LugMates




### LugMates/Bus Bars

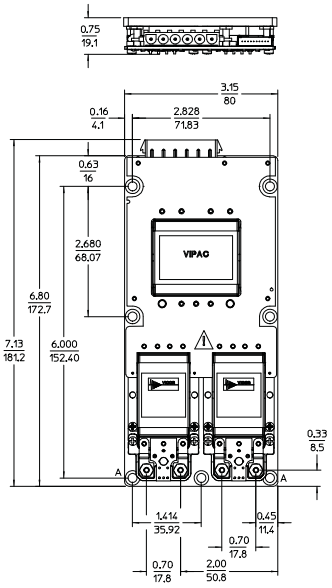



### PlugMates

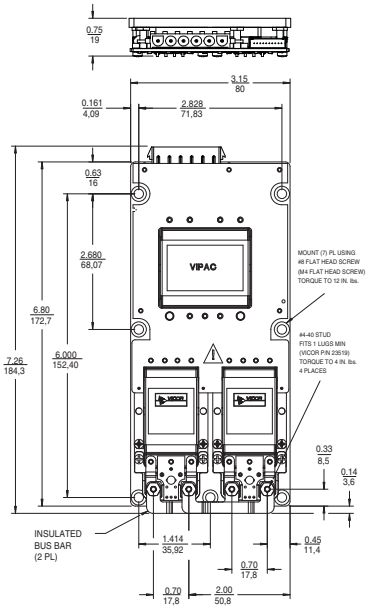



## Configuration VP-D

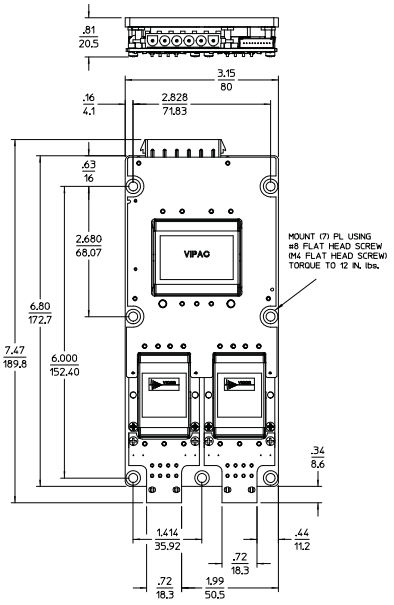
### LugMates




### LugMates/Bus Bars




### PlugMates



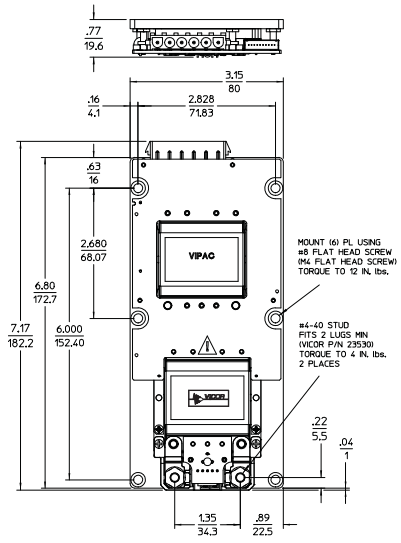

| Torque in. / lbs. | Feature | MOUNTING | | | Max. Chassis Temp. |
|---|---|---|---|---|---|
| | | Locations indicated by | Type | Quantity of holes provided for VIPAC Model Configuration | |
| | Coldplate (Thermal interface material required) | ◎ ◉ | Clearance holes for 8-32 90 CS to .30 | VP - 6 A 6 B 6 C 5 D 6 E 6 F 6 G | 95°C |
| 12 | Finned heat sink | ◎ | threaded thru hole for 8-32 | VP - 6 A 6 B 6 C 5 D 6 E 6 F 6 G | 95°C |
| 4<br>16 | Micro Lugmate<br>Mini/Maxi Lugmates | | | | |

All dimensions are $\frac{\text{in}}{\text{mm}}$

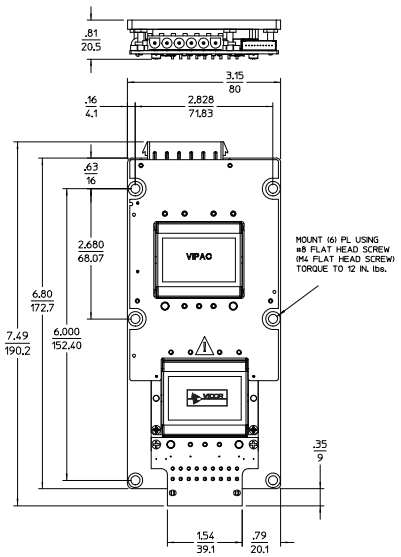
# MECHANICAL DRAWINGS

## Configuration VP-E

### LugMates

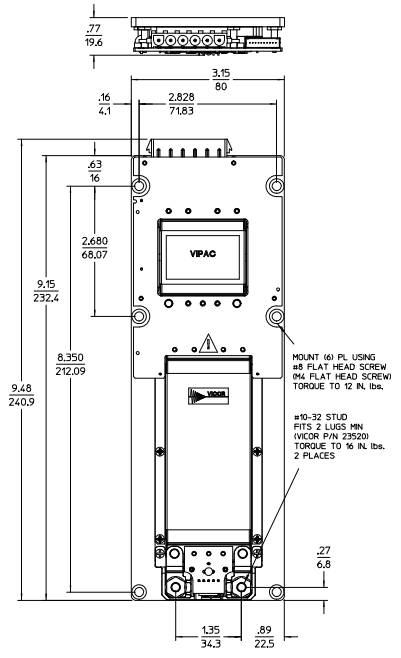



### PlugMates

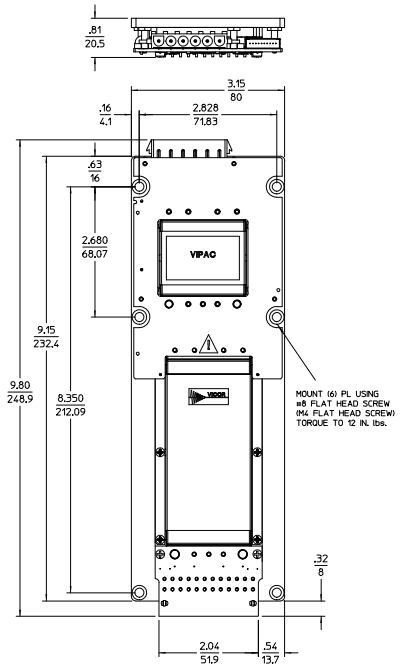



## Configuration VP-F

### LugMates




### PlugMates



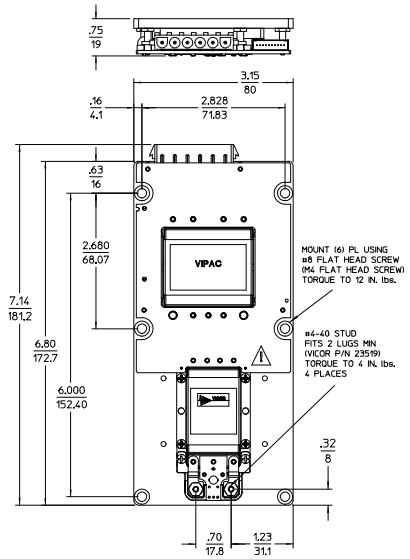

| Torque in. / lbs. | Feature | MOUNTING | | | Max. Chassis Temp. |
|---|---|---|---|---|---|
| | | Locations indicated by | Type | Quantity of holes provided for VIPAC Model Configuration | |
| | Coldplate (Thermal interface material required) | ◎ ◉ | Clearance holes for 8-32 90 CS to .30 | VP - 6 A 6 B 6 C 5 D 6 E 6 F 6 G | 95°C |
| 12 | Finned heat sink | ◎ | threaded thru hole for 8-32 | VP - 6 A 6 B 6 C 5 D 6 E 6 F 6 G | 95°C |
| 4<br>16 | Micro Lugmate<br>Mini/Maxi Lugmates | | | | |

All dimensions are $\frac{\text{in}}{\text{mm}}$

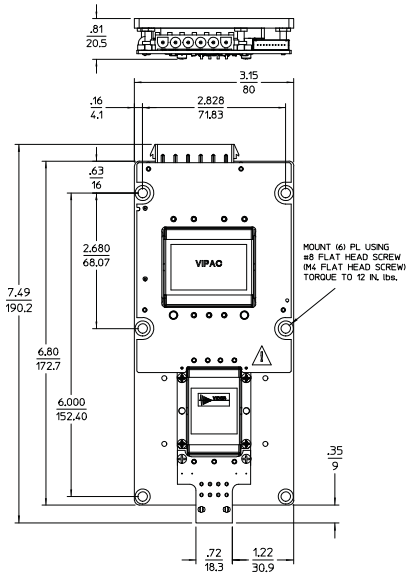
# MECHANICAL DRAWINGS

## Configuration VP-G

### LugMates




### PlugMates

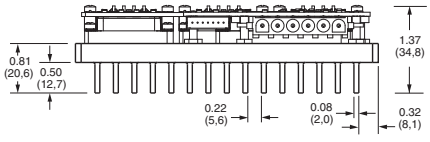



| Torque in. / lbs. | Feature | MOUNTING | | | Max. Chassis Temp. |
|---|---|---|---|---|---|
| | | Locations indicated by | Type | Quantity of holes provided for VIPAC Model Configuration | |
| | Coldplate (Thermal interface material required) | ◎ ◉ | Clearance holes for 8-32 90 CS to .30 | VP - 6 A 6 B 6 C 5 D 6 E 6 F 6 G | 95°C |
| 12 | Finned heat sink | ◎ | threaded thru hole for 8-32 | VP - 6 A 6 B 6 C 5 D 6 E 6 F 6 G | 95°C |
| 4<br>16 | Micro Lugmate<br>Mini/Maxi Lugmates | | | | |

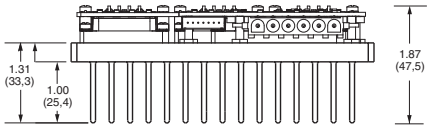
All dimensions are $\frac{\text{in}}{\text{mm}}$

## Heat Sink Options

**Coldplate**




**0.5" Fin Option**




**1" Fin Option**

Fin spacing and relief
are the same for both Fin options.

# MECHANICAL INFORMATION

### VIPAC Product Weight

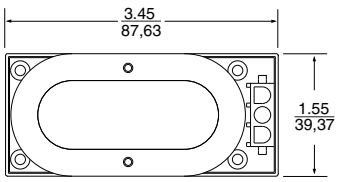
| VIPAC Model Prefix | Chassis Configuration | Chassis Configuration: Coldplate Pounds | Coldplate Grams | 0.5" Fins Pounds | 0.5" Fins Grams | 1" Fins Pounds | 1" Fins Grams |
|---|---|---|---|---|---|---|---|
| **VP-G** | 1 Micro | 0.9 | 411 | 1.4 | 640 | 1.6 | 731 |
| **VP-D** | 2 Micro | 1.0 | 457 | 1.5 | 686 | 1.7 | 777 |
| **VP-A** | 3 Micro | 1.4 | 640 | 2.2 | 1006 | 2.5 | 1143 |
| **VP-E** | 1 Mini | 1.0 | 457 | 1.4 | 640 | 1.6 | 731 |
| **VP-B** | 2 Mini | 1.4 | 640 | 2.2 | 1006 | 2.6 | 1189 |
| **VP-F** | 1 Maxi | 1.3 | 594 | 2.0 | 914 | 2.3 | 1051 |
| **VP-C** | 2 Maxi | 2.2 | 1006 | 3.0 | 1371 | 3.5 | 1600 |

### VIPAC Standoff Mounting Kits

| Vicor Kit P/N | Kit Description | For use with: |
|---|---|---|
| 23709R | Qty. 6 – #23655 long standoff | 1″ finned heat sinks |
| 23710R | Qty. 6 – #23656 short standoff | 1/2″ finned heat sinks or coldplate |

### Hold-up Box (HUB)

**Top view, HUB**




| Description* | Height (Inches ±.06") | Height (mm) | Weight Ounces | Weight Grams | Part Number |
|---|---|---|---|---|---|
| 820 µF | 1.55 | 39,4 | 3.95 | 112 | HUB820-S |
| 1200 µF | 1.75 | 44,5 | 4.85 | 137 | HUB1200-S |
| 1800 µF | 2.14 | 54,4 | 6.11 | 173 | HUB1800-S |
| 2200 µF | 2.85 | 72,4 | 7.44 | 211 | HUB2200-S |
| 2700 µF | 3.52 | 89,4 | 8.70 | 247 | HUB2700-S |
| 3300 µF | 3.52 | 89,4 | 9.38 | 266 | HUB3300-S |

* Each HUB contains two (2) capacitors of the value shown.

Maximum cable length between the HUB and *VIPAC* ≤ 3'

### Thermal Impedance Specifications (°C/W)

| | | | Airflow | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **VIPAC Model Prefix** | **Chassis Config.** | **Heat Sink** | **Natural Convection** | **200 (LFM)** | **400 (LFM)** | **600 (LFM)** | **800 (LFM)** | **1000 (LFM)** | **1200 (LFM)** |
| **VP-A** | 3 Micro | 0.5" L | 1.98 | 0.77 | 0.53 | 0.45 | 0.39 | 0.36 | 0.33 |
| | | 0.5" T | 1.71 | 0.68 | 0.48 | 0.40 | 0.36 | 0.33 | 0.30 |
| | | 1.0" L | 1.68 | 0.58 | 0.42 | 0.36 | 0.32 | 0.30 | 0.28 |
| | | 1.0" T | 1.27 | 0.46 | 0.33 | 0.28 | 0.25 | 0.23 | 0.21 |
| **VP-B** | 2 Mini | 0.5" L | 1.90 | 0.77 | 0.53 | 0.44 | 0.39 | 0.36 | 0.33 |
| | | 0.5" T | 1.67 | 0.69 | 0.48 | 0.41 | 0.37 | 0.33 | 0.31 |
| | | 1.0" L | 1.49 | 0.54 | 0.39 | 0.34 | 0.31 | 0.28 | 0.27 |
| | | 1.0" T | 1.22 | 0.47 | 0.33 | 0.28 | 0.25 | 0.23 | 0.21 |
| **VP-C** | 2 Maxi | 0.5" L | 1.50 | 0.62 | 0.42 | 0.35 | 0.31 | 0.28 | 0.25 |
| | | 0.5" T | 1.19 | 0.52 | 0.36 | 0.31 | 0.27 | 0.25 | 0.23 |
| | | 1.0" L | 1.17 | 0.43 | 0.31 | 0.27 | 0.24 | 0.22 | 0.20 |
| | | 1.0" T | 0.86 | 0.35 | 0.25 | 0.21 | 0.19 | 0.17 | 0.16 |
| **VP-D** | 2 Micro | 0.5" L | 3.13 | 1.28 | 0.89 | 0.74 | 0.66 | 0.59 | 0.54 |
| | | 0.5" T | 2.40 | 1.02 | 0.73 | 0.63 | 0.56 | 0.51 | 0.47 |
| | | 1.0" L | 2.81 | 0.97 | 0.70 | 0.60 | 0.54 | 0.50 | 0.46 |
| | | 1.0" T | 1.87 | 0.75 | 0.55 | 0.47 | 0.42 | 0.39 | 0.35 |
| **VP-E** | 1 Mini | 0.5" L | 3.11 | 1.26 | 0.88 | 0.74 | 0.65 | 0.59 | 0.54 |
| | | 0.5" T | 2.39 | 1.01 | 0.73 | 0.62 | 0.56 | 0.51 | 0.47 |
| | | 1.0" L | 2.51 | 0.87 | 0.64 | 0.56 | 0.51 | 0.48 | 0.45 |
| | | 1.0" T | 1.76 | 0.70 | 0.52 | 0.44 | 0.40 | 0.37 | 0.33 |
| **VP-F** | 1 Maxi | 0.5" L | 2.42 | 1.02 | 0.69 | 0.57 | 0.50 | 0.45 | 0.41 |
| | | 0.5" T | 1.72 | 0.77 | 0.55 | 0.47 | 0.42 | 0.38 | 0.37 |
| | | 1.0" L | 2.01 | 0.72 | 0.52 | 0.45 | 0.41 | 0.38 | 0.36 |
| | | 1.0" T | 1.26 | 0.53 | 0.38 | 0.33 | 0.29 | 0.27 | 0.25 |
| **VP-G** | 1 Micro | 0.5" L | 3.13 | 1.28 | 0.89 | 0.74 | 0.66 | 0.59 | 0.54 |
| | | 0.5" T | 2.40 | 1.02 | 0.73 | 0.63 | 0.56 | 0.51 | 0.47 |
| | | 1.0" L | 2.81 | 0.97 | 0.70 | 0.60 | 0.54 | 0.50 | 0.46 |
| | | 1.0" T | 1.87 | 0.75 | 0.55 | 0.47 | 0.42 | 0.39 | 0.35 |

### Suggested Wire Gauge

| Function | Wire Gauge | Application |
|---|---|---|
| AC Input Leads | #14 | All AC and earth GND ⏚ leads (VIPAC power systems) |
| DC Output Leads | #20 | 0 A – 3 A |
| | #18 | 4 A – 6 A |
| | #16 | 7 A – 10 A |
| | #14 | 11 A – 15 A |
| | #12 | 16 A – 25 A |
| | #10 | 26 A – 40 A |
| | #8 | 41 A – 65 A |
| | #6 | 66 A – 104 A |
| | #4 | 105 A – 160 A |

### Mating Connector Cross Reference

| Designator | Description | Manufacturer | Part Number Pin | Part Number Housing |
|---|---|---|---|---|
| **J2** | VIPAC AC Input - 6 Pin | TE Connectivity | 350551-1 | 640585-1 |
| **J3** | VIPAC I/O Interface - 10 Pin | JST | 10ZR-3H or 10ZR-3H-P | |
| **J4** | VIPAC Output Control - 5 Pin | TE Connectivity | MTA100-IDC644083-5 | |
| | HUB 820-S, 1200-S, 1800-S 3 Pin | TE Connectivity | 770248-1 | 770018-1 |
| | HUB 2200-S, 2700-S, 3300-S 3 Pin | TE Connectivity | 193842-1 | 770018-1 |
| | Micro PlugMate mating connector - 8 pin | TE Connectivity | 1-106529-2 | TYC-794657-8 |
| | Mini PlugMate mating connector - 18 pin | TE Connectivity | 1-106529-2 | TYC1-794657-8 |
| | Maxi PlugMate mating connector - 24 pin | TE Connectivity | 1-106529-2 | TYC2-794657-4 |

# Application Tips

### Selecting Heat Sinks

VIPAC Power Systems are rated for a maximum chassis temperature of 95˚C. Operation within these limits is essential for long life and users should select an appropriate thermal management system. The thermal performance of a particular VIPAC chassis configuration can be approximated from the thermal resistance of the chassis, ambient operating temperature and total power dissipation, using a few simple formulas shown below.

**Thermal Resistance:** Refer to pg 22

**Power Dissipation:** Calculated as: (Pout / Efficiency) –Pout

***Example:***

Verify a 500 W, 28 Vdc output VIPAC does not exceed 95˚C chassis temperature (Tc).

- VP-C chassis configuration with 1" transverse heat sink is selected and 200 lfm airflow is provided.
- Thermal resistance (θ) of 0.35˚C/W is obtained from the chart on pg 22.
- Ambient operating temperature ($T_A$) specified by the user is 40˚C.
- VIPAC Power System efficiency (η) is 80% overall.

***Formula:***

$$Tc = \left(\left(\frac{Pout}{\eta} - Pout\right) \times \theta\right) + T_A$$

$$= \left(\left(\frac{500}{0.8} - 500\right) \times 0.35\right) + 40$$

$$= 83.75^{\circ}C$$

***Conclusion:***

This VIPAC will operate in the conditions specified and not exceed maximum chassis temperature.

***Comment:***

Efficiency of a particular VIPAC will depend on the specific output voltages and operating load conditions.
In general the efficiency of VIPACs with outputs of 5 Vdc or less is approximately 70% and those with outputs greater than 5 Vdc is 80%. A more accurate calculation can be derived by summing dissipation of each DC-DC converter module used in the VIPAC and the front-end section of the VIPAC (using 95% efficiency for the front-end).

### VIPAC Power System Dissipation

$$Pdiss = \sum_{1-n} \frac{\frac{Pout\ (n)}{\eta(n)}}{0.95} - Pout\ (n)$$

### Remote Sense

A remote sense feature is provided on outputs configured with Mini or Maxi sized DC-DC converters. The output sense connections must be terminated either locally or remotely and may not be left open. **The sense lines for VIPACs configured with a single paralleled output must be terminated to the same point**. VIPACs provided with the optional LugMate connectors are configured for local sensing via removable jumpers installed at the factory. The jumpers will need to be removed if access to the secondary control function is made via mating connector P/N 16385 and connections will need to be established for local or remote sensing.

### Hold up Capacitors

Hold up capacitors can be located remotely with up to 3' of cable. Vicor applications engineering should be consulted for projects requiring greater separation.

### Wire Routing

Avoid routing wires over VIPAC Power System.
Do not bundle Input and Output leads together.

### Crimping Tool

| Amp Hand Tool P/N | Die Set # | Wire Size |
|---|---|---|
| 91508-1 | | 20-18 AWG |
| 91506-1 | | 16-14 AWG |
| 69710-1 | 58380-1 | 12 AWG |
| | 58380-2 | 10 AWG |

### Parallel Outputs

The VIPAC can be configured with parallel modules for increased power or redundancy. When used for increased power, short the SC pin to –Sense on one module.
This configures the module as a Booster. The user must properly connect the output and sense terminals (See above).
**At no time operate a paralleled output with a load applied only to one module!** ***(See Output Connection Options)***

# TECHNICAL SUPPORT CONTACTS

For a complete and updated list of contacts visit Vicor at:
http://www.vicorpower.com/contact-us?selectedTab=%23contact_tab2

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