



Actual size:
4.6 x 2.2 x 0.5 in
117 x 56 x 12,7 mm

Maxi Family
28 V Wide Input



DC-DC Converter Module

Features

- DC input range: 9 – 36 V*
- Isolated output
- Input surge withstand: 50 V for 100 ms
- DC output: 3.3 – 48 V
- Programmable output: 10 to 110%
- Regulation: –0.2% no load to full load
- Efficiency: Up to 85%
- Maximum operating temp: 100 °C
- Power density: up to 40 W per cubic inch
- Height above board: 0.43 in. (10,9 mm)
- Parallelable, with N+M fault tolerance
- Low noise ZCS/ZVS architecture
- RoHS Compliant (with F or G pin option)

Product Overview

These DC-DC converter modules use advanced power processing, control and packaging technologies to provide the performance, flexibility, reliability and cost effectiveness of a mature power component. High frequency ZCS/ZVS switching provides high power density with low noise and high efficiency.

Applications

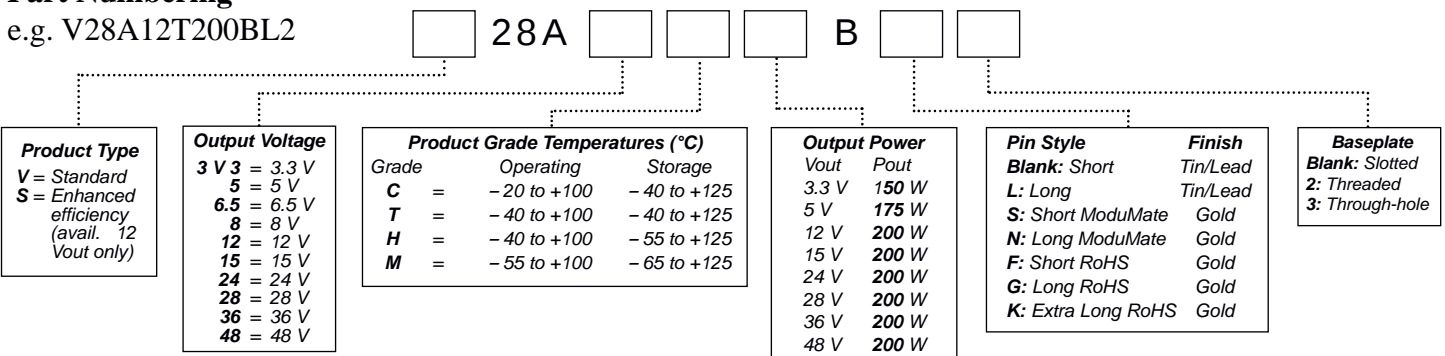
Industrial and process control, distributed power, medical, ATE, communications, defense, aerospace.

*10-36 V DC input range for 3.3, 6.5, 8, 36 and 48 V outputs. All others derate power to 75% for $V_{in} > 10$ V.

For details on proper operation please refer to the [Design Guide & Applications Manual for Maxi, Mini, Micro Family](#).

Part Numbering

e.g. V28A12T200BL2



Absolute Maximum Ratings

| Parameter | Rating | Unit | Notes |
|------------------------------|--------------|--------------|----------------------------------|
| +In to –In voltage | -0.5 to +53 | Vdc | |
| PC to –In voltage | -0.5 to +7.0 | Vdc | |
| PR to –In voltage | -0.5 to +7.0 | Vdc | |
| SC to –Out voltage | -0.5 to +1.5 | Vdc | |
| –Sense to –Out voltage | 1.0 | Vdc | |
| +Out to –Out, +Sense to –Out | | | See Module Output Specifications |
| Isolation voltage | | | |
| in to out | 3000 | Vrms | Test voltage |
| in to base | 1500 | Vrms | Test voltage |
| out to base | 500 | Vrms | Test voltage |
| Operating Temperature | -55 to +100 | °C | M-Grade |
| Storage Temperature | -65 to +125 | °C | M-Grade |
| Pin soldering temperature | 500 (260) | °F (°C) | <5 sec; wave solder |
| | 750 (390) | °F (°C) | <7 sec; hand solder |
| Mounting torque | 5 (0.57) | in-lbs (N-m) | 6 each |

MODULE FAMILY ELECTRICAL CHARACTERISTICS

Electrical characteristics apply over the full operating range of input voltage, output load (resistive) and baseplate temperature, unless otherwise specified. All temperatures refer to the operating temperature at the center of the baseplate.

■ MODULE INPUT SPECIFICATIONS

| Parameter | Min | Typ | Max | Unit | Notes |
|-------------------------|------|------|------|------|------------|
| Operating input voltage | 9 | 28 | 36 | Vdc | |
| Input surge withstand | | | 50 | Vdc | <100 ms |
| Undervoltage turn-on | | 8.75 | 8.9 | Vdc | |
| Undervoltage turn-off | 7.8 | 8.1 | 8.4 | Vdc | |
| Overvoltage turn-off/on | 36.3 | 37.8 | 39.6 | Vdc | |
| Disabled input current | | 12 | 14 | mA | PC pin low |

■ MODULE OUTPUT SPECIFICATIONS

| Parameter | Min | Typ | Max | Unit | Notes |
|--|-----|--------|--------------|----------|---|
| Output voltage set point | | | ±1% | Vout nom | Nominal input; full load; 25°C |
| Line regulation | | ±0.02 | ±0.20 | % | Low line to high line; full load |
| Temperature regulation | | ±0.002 | ±0.005 | % / °C | Over operating temperature range |
| Power sharing accuracy | | ±2 | ±5 | % | 10 to 100% of full load |
| Programming range | 10 | | 110 | % | Of nominal output voltage. For trimming below 90% of nominal, a minimum load of 10% of maximum rated power may be required. |
| +Out to -Out, +Sense to -Out ... Absolute Maximum Ratings | | | | | |
| 3.3 V | | | -0.5 to 4.7 | Vdc | Externally Applied |
| 5 V | | | -0.5 to 7.0 | Vdc | Externally Applied |
| 6.5 V | | | -0.5 to 9.0 | Vdc | Externally Applied |
| 8 V | | | -0.5 to 10.9 | Vdc | Externally Applied |
| 12 V | | | -0.5 to 16.1 | Vdc | Externally Applied |
| 15 V | | | -0.5 to 20.0 | Vdc | Externally Applied |
| 24 V | | | -0.5 to 31.7 | Vdc | Externally Applied |
| 28 V | | | -0.5 to 36.9 | Vdc | Externally Applied |
| 36 V | | | -0.5 to 47.2 | Vdc | Externally Applied |
| 48 V | | | -0.5 to 62.9 | Vdc | Externally Applied |

■ THERMAL RESISTANCE AND CAPACITY

| Parameter | Min | Typ | Max | Unit |
|--|-----|------|-----|-------------|
| Baseplate to sink; flat, greased surface | | 0.08 | | °C/Watt |
| Baseplate to sink; thermal pad (P/N 20263) | | 0.07 | | °C/Watt |
| Baseplate to ambient | | 4.9 | | °C/Watt |
| Baseplate to ambient; 1000 LFM | | 1.1 | | °C/Watt |
| Thermal capacity | | 165 | | Watt-sec/°C |

■ MODULE CONTROL SPECIFICATIONS

| Parameter | Min | Typ | Max | Unit | Notes |
|---|------|-------|------|---------|--|
| PRIMARY SIDE (PC = Primary Control; PR = Parallel) | | | | | |
| PC bias voltage | 5.50 | 5.75 | 6.00 | Vdc | PC current = 1.0 mA PC voltage = 5.5 V During normal operation |
| current limit | 1.5 | 2.1 | 3.0 | mA | |
| PC module disable | 2.3 | 2.6 | 2.9 | Vdc | Switch must be able to sink 4 mA. See Fig. 2 |
| PC module enable delay | | 4 | 7 | ms | |
| PC module alarm | | | 0.5 | Vavg | UV, OV, OT, module fault. See Figs. 3 and 5 |
| PC resistance | 0.9 | 1.0 | 1.1 | M | See Fig. 3, converter off or fault mode |
| PR emitter amplitude | 5.7 | 5.9 | 6.1 | Volts | PR load >30 , <30 pF |
| PR emitter current | 150 | | | mA | |
| PR receiver impedance | 375 | 500 | 625 | | 25°C |
| PR receiver threshold | 2.4 | 2.5 | 2.6 | Volts | Minimum pulse width: 20 ns |
| PR drive capability | | | 12 | modules | Without PR buffer amplifier |
| SECONDARY SIDE (SC = Secondary Control) | | | | | |
| SC bandgap voltage | 1.21 | 1.23 | 1.25 | Vdc | Referenced to –Sense |
| SC resistance | 990 | 1000 | 1010 | | |
| SC capacitance | | 0.033 | | F | |
| SC module alarm | | 0 | | Vdc | With open trim; referenced to –Sense. See Fig. 7 |

■ MODULE GENERAL SPECIFICATIONS

| Parameter | Min | Typ | Max | Unit | Notes |
|---------------------------------------|----------------|-------------------|----------------|-------------------|--|
| Remote sense (total drop) | | | 0.5 | Vdc | 0.25 V per leg (sense leads must be connected to respective, output terminals) |
| Isolation test voltage (in to out)* | 3000 | | | Vrms | Complies with reinforced insulation requirements |
| Isolation test voltage (in to base)* | 1500 | | | Vrms | Complies with basic insulation requirements |
| Isolation test voltage (out to base)* | 500 | | | Vrms | Complies with operational insulation requirements |
| Isolation resistance | | 10 | | M | in to out, in to baseplate, out to baseplate |
| Weight (E, C, T grade) | 6.5 (184.3) | 7.3 (207.5) | 8.1 (230.7) | ounces (grams) | |
| Weight (H, M grade) | 7.4 (209.3) | 8.2 (232.5) | 9.0 (255.7) | ounces (grams) | |
| Temperature limiting | 100 | 115 | | °C | See Figs. 3 and 5. Do not operate converter >100C. |
| Agency approvals | | cURus, cTÜVus, CE | | | UL60950-1, EN60950-1, CSA60950-1, IEC60950-1. With appropriate fuse in series with the +Input |

* Isolation test voltage, 1 minute or less.

Note:

Specifications are subject to change without notice.

■ MODULE SPECIFIC OPERATING SPECIFICATIONS (CONT.)

12 Vout, 200 W (e.g. S28A12C200BL, V28A12C200BL)

| Parameter | Min | Typ | Max | Unit | Notes |
|------------------------------------|------|-------|-------|-------|--|
| Efficiency | | | | | |
| S28A12C200BL (enhanced efficiency) | 83.5 | 85.5 | | % | Nominal input; full load; 25°C |
| V28A12C200BL (standard efficiency) | 81.0 | 83.0 | | | |
| Ripple and noise | | 280 | 350 | mV | p-p; Nominal input; full load; 20 MHz bandwidth |
| Output OVP set point | 13.7 | 14.3 | 14.9 | Volts | 25°C; recycle input voltage or PC to restart (>100 ms off) |
| Dissipation, stand-by | | 11.0 | 12.2 | Watts | No load |
| Load regulation | | ±0.02 | ±0.2 | % | No load to full load; nominal input |
| Load Current | 0 | | 16.67 | Amps | |
| Current limit | 17.0 | 19.2 | 22.6 | Amps | Output voltage 95% of nominal |
| Short circuit current | 11.6 | 19.2 | 22.6 | Amps | Output voltage < 250mV |

15 Vout, 200 W (e.g. V28A15C200BL)

| Parameter | Min | Typ | Max | Unit | Notes |
|-----------------------|------|-------|-------|-------|--|
| Efficiency | 82.2 | 84.5 | | % | Nominal input; full load; 25°C |
| Ripple and noise | | 220 | 275 | mV | p-p; Nominal input; full load; 20 MHz bandwidth |
| Output OVP set point | 17.1 | 17.8 | 18.5 | Volts | 25°C; recycle input voltage or PC to restart (>100 ms off) |
| Dissipation, stand-by | | 12.7 | 13.7 | Watts | No load |
| Load regulation | | ±0.02 | ±0.2 | % | No load to full load; nominal input |
| Load Current | 0 | | 13.33 | Amps | |
| Current limit | 13.5 | 15.3 | 20.6 | Amps | Output voltage 95% of nominal |
| Short circuit current | 9.31 | 15.3 | 20.6 | Amps | Output voltage <250 mV |

24 Vout, 200 W (e.g. V28A24C200BL)

| Parameter | Min | Typ | Max | Unit | Notes |
|-----------------------|------|-------|------|-------|--|
| Efficiency | 82.8 | 86.0 | | % | Nominal input; full load; 25°C |
| Ripple and noise | | 315 | 394 | mV | p-p; Nominal input; full load; 20 MHz bandwidth |
| Output OVP set point | 27.1 | 28.1 | 29.1 | Volts | 25°C; recycle input voltage or PC to restart (>100 ms off) |
| Dissipation, stand-by | | 12.3 | 13.5 | Watts | No load |
| Load regulation | | ±0.02 | ±0.2 | % | No load to full load; nominal input |
| Load Current | 0 | | 8.33 | Amps | |
| Current limit | 8.49 | 9.6 | 11.3 | Amps | Output voltage 95% of nominal |
| Short circuit current | 5.83 | 9.6 | 11.3 | Amps | Output voltage <250 mV |

■ SPECIFIC SPECIFICATIONS

28 Vout, 20W e.g. V2828C2P

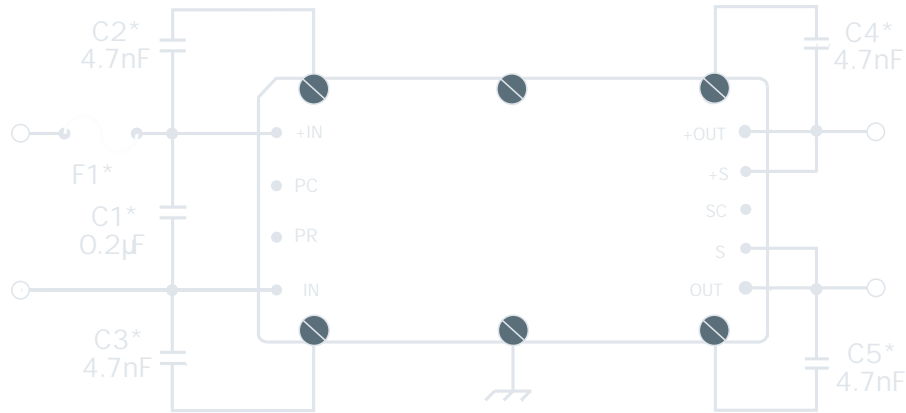
| Parameter | Min | Typ | Max | Unit | Notes |
|-----------------------|------|------|-------|-------|--|
| Efficiency | | 83.5 | 85.0 | % | Nominal input; full load; 25°C |
| Ripple and noise | | | 200 | mV | p-p; Nominal input; full load; 20 MHz bandwidth |
| Output OVP set point | 31.5 | | 32.7 | V | 25°C; recycle; input voltage or PC to restart (>100ms off) |
| Dissipation, stand-by | | | 15.5 | Watts | No load |
| Load regulation | | | -0.02 | % | No load to full load; nominal input |
| Load Current | 0 | | 7.14 | Amps | |
| Current limit | 7.28 | | 8.2 | Amps | Output voltage 95% of nominal |
| Short circuit current | 4.99 | | 8.2 | Amps | Output voltage <250 mV |

30Vout, 20W e.g. V2830P

| Parameter | Min | Typ | Max | Unit | Notes |
|-----------------------|------|------|-------|-------|--|
| Efficiency | | 80.9 | 82.6 | % | Nominal input; full load; 25°C |
| Ripple and noise | | | 225 | mV | p-p; Nominal input; full load; 20 MHz bandwidth |
| Output OVP set point | 40.4 | | 41.9 | V | 25°C; recycle; input voltage or PC to restart (>100ms off) |
| Dissipation, stand-by | | | 14.4 | Watts | No load |
| Load regulation | | | -0.02 | % | No load to full load; nominal input |
| Load Current | 0 | | 5.56 | Amps | |
| Current limit | 5.67 | | 7.7 | Amps | Output voltage 95% of nominal |
| Short circuit current | 3.89 | | 6.9 | Amps | Output voltage <250 mV |

33 Vout, 20W e.g. V2833C2P

| Parameter | Min | Typ | Max | Unit | Notes |
|-----------------------|------|------|-------|-------|--|
| Efficiency | | 81.8 | 82.6 | % | Nominal input; full load; 25°C |
| Ripple and noise | | | 360 | mV | p-p; Nominal input; full load; 20 MHz bandwidth |
| Output OVP set point | 53.7 | | 55.7 | V | 25°C; recycle; input voltage or PC to restart (>100ms off) |
| Dissipation, stand-by | | | 15.6 | Watts | No load |
| Load regulation | | | -0.02 | % | No load to full load; nominal input |
| Load Current | 0 | | 4.17 | Amps | |
| Current limit | 4.25 | | 4.4 | Amps | Output voltage 95% of nominal |
| Short circuit current | 2.92 | | 4.8 | Amps | Output voltage <250 mV |



For C1 – C5, keep leads and connections short.

Comprehensive Online Application Information



The Design Guide and Applications Manual includes

- Application circuits
- Design requirements
- EMC considerations
- Current sharing in power arrays
- Thermal performance information
- Recommended soldering methods
- Accessory modules filtering, rectification, f
- Mounting options

...and more.



Also at vicorpower.com

- PowerBench online configurators
- Over 20 Application Notes
- Online calculators thermal, trimming, hold-up
- PDF data sheets for ALL Vicor products

SECONDARY CONTROL - SC PIN

Output Voltage Programming

The output voltage of the converter can be adjusted or programmed via fixed resistors, potentiometers or voltage DACs. See Figure 8.

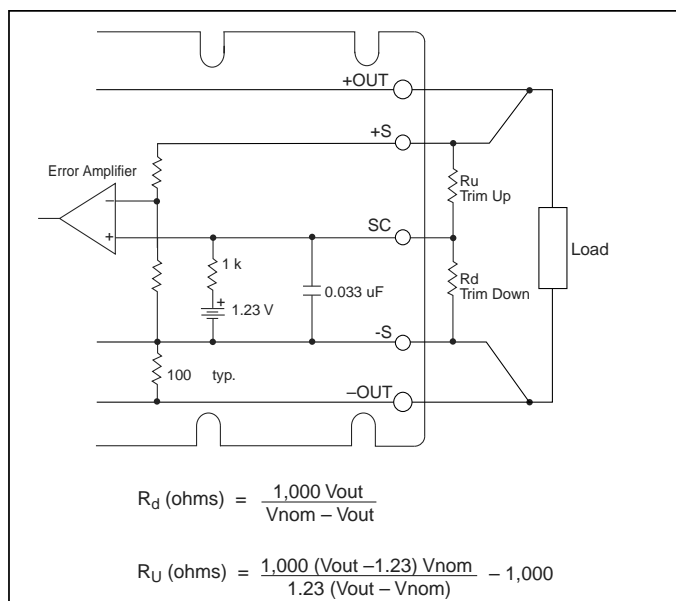


Figure 8,, Output voltage trim down and trim up circuit.

Trim Down

1. This converter is not constant power device ... it has a constant current limit. Hence, available output power is reduced by the same percentage that output voltage is trimmed down. **Do not** exceed maximum rated output current.
2. The trim down resistor must be connected between the SC and -S pins. Do not bypass the SC pin directly with a capacitor.

Trim Up

1. The converter is rated for a maximum delivered power. To ensure that maximum rated power is not exceeded, reduce maximum output current by the same percentage increase in output voltage.
2. The trim up resistor must be connected between the SC and +S pins. Do not bypass the SC pin directly with a capacitor.
3. Do not trim the converter above maximum trim range (typically +10%) or the output over voltage protection circuitry may be activated.

Trim resistor values calculated automatically:

On-line calculators for trim resistor values are available on the vicor website at:

asp.vicorpower.com/calculators/calculators.asp?calc=1

Resistor values can be calculated for fixed trim up, fixed trim down and for variable trim up or down.

PARALLEL BUS - PR PIN

Parallel Operation

The PR pin supports paralleling for increased power with N+1 (N+M) redundancy. Modules of the same input voltage, output voltage, and power level will current share if all PR pins are suitably interfaced.

Compatible interface architectures include the following:

AC coupled single-wire interface: All PR pins are connected to a single communication bus through 0.001 F (500 V) capacitors. This interface supports current sharing and is fault tolerant except for the communication bus. Up to three converters may be paralleled by this method. See Figure 9.

Transformer coupled interface: For paralleling four or more converters a transformer coupled interface is required. See Figure 10.

For details on parallel operation please refer to the

Design Guide & Applications Manual for Maxi, Mini, Micro Family.

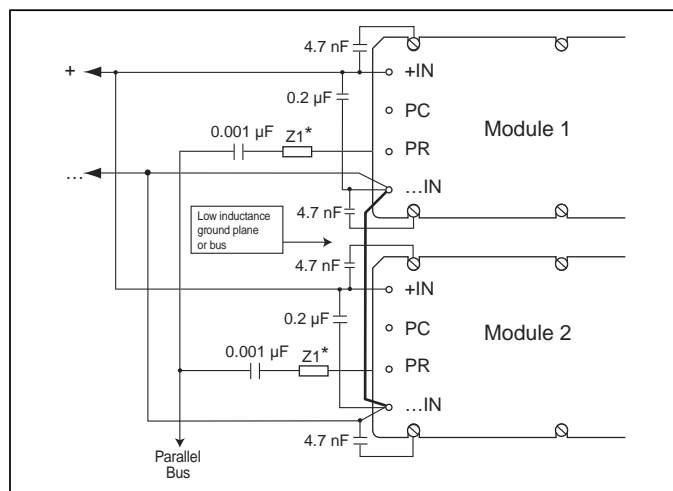


Figure 9,, AC coupled single-wire interface.

* See Maxi, Mini, Micro Design Guide.

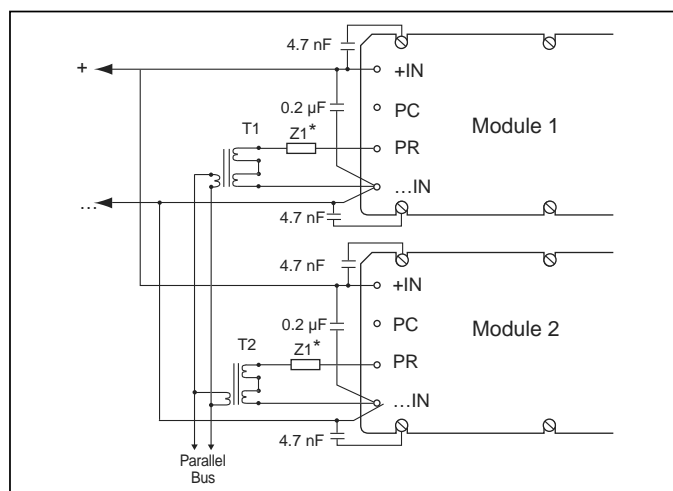


Figure 10,, Transformer-coupled interface.

PARALLEL BUS OUTPUT

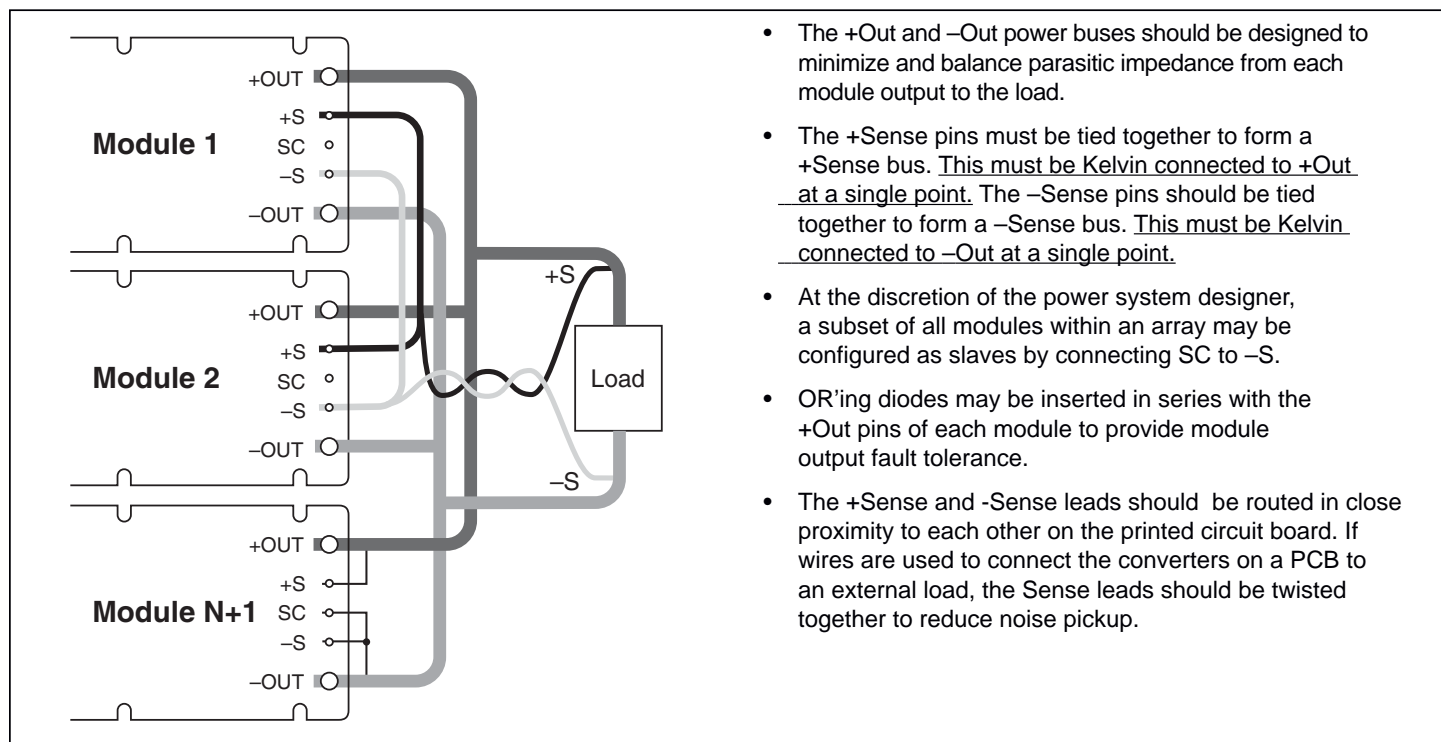


Figure 11 N+1 module array output connections.

■ PIN STYLES*

| Designator | Description | Finish | Notes |
|------------|-----------------|----------|--|
| (None) | Short | Tin/Lead | Requires in-board, mounting |
| L | Long | Tin/Lead | On-board mounting for 0.065" boards |
| S | Short ModuMate | Gold | SurfMate or in-board socket mounting |
| N | Long ModuMate | Gold | On-board socket mounting |
| F | Short RoHS | Gold | Select for RoHS compliant in-board solder, socket, or SurfMate mounting |
| G | Long RoHS | Gold | Select for RoHS compliant on-board solder or socket mounting |
| K | Extra Long RoHS | Gold | Select for RoHS compliance on-board mounting for thicker PCBs (not intended for socket or Surfmate mounting) |

* Pin style designator follows the "B" after the output power and precedes the baseplate designator.
Ex. V48A12T500BN2 — Long ModuMate Pins

MECHANICAL DRAWINGS

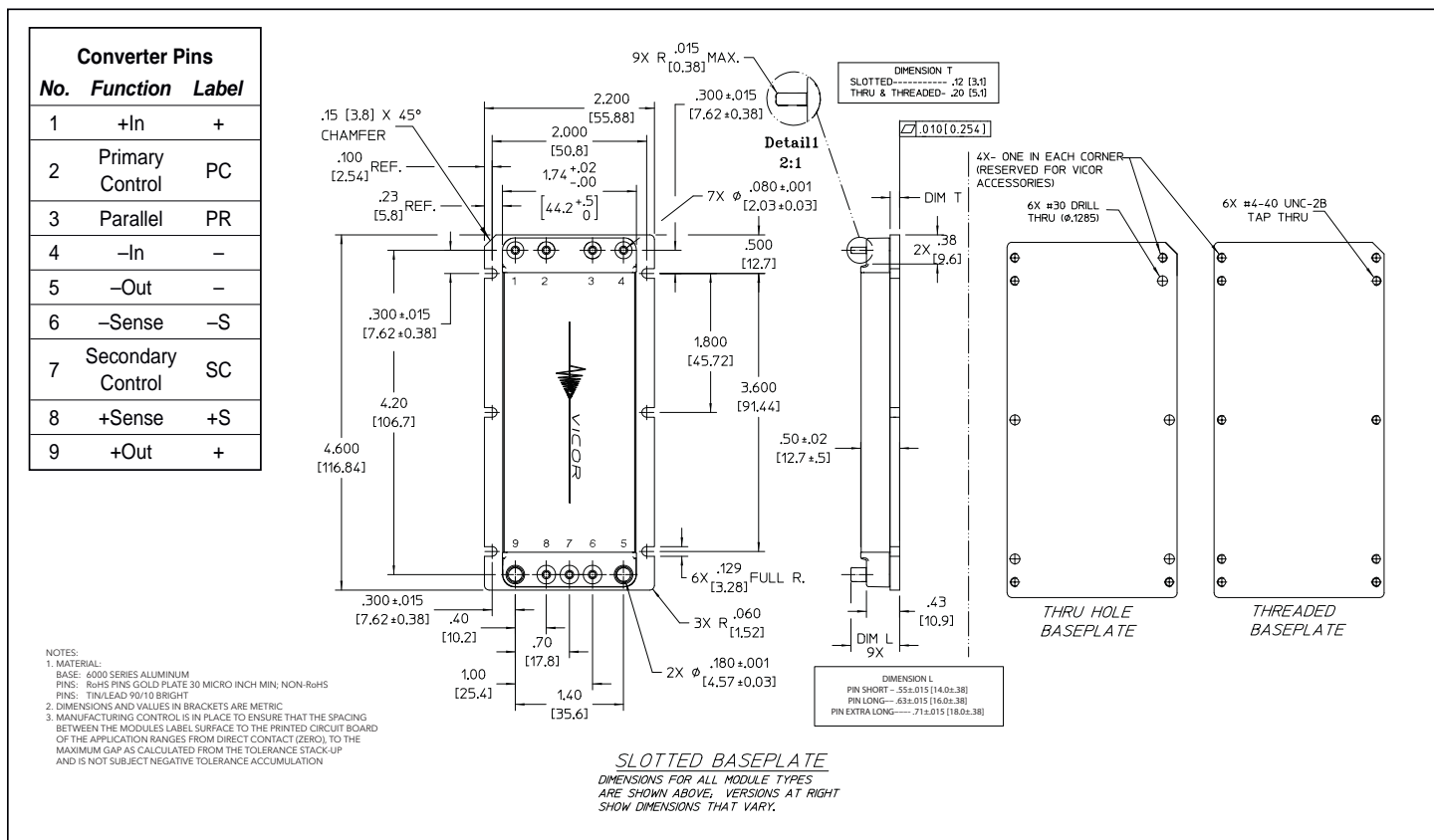


Figure 12 Module outline

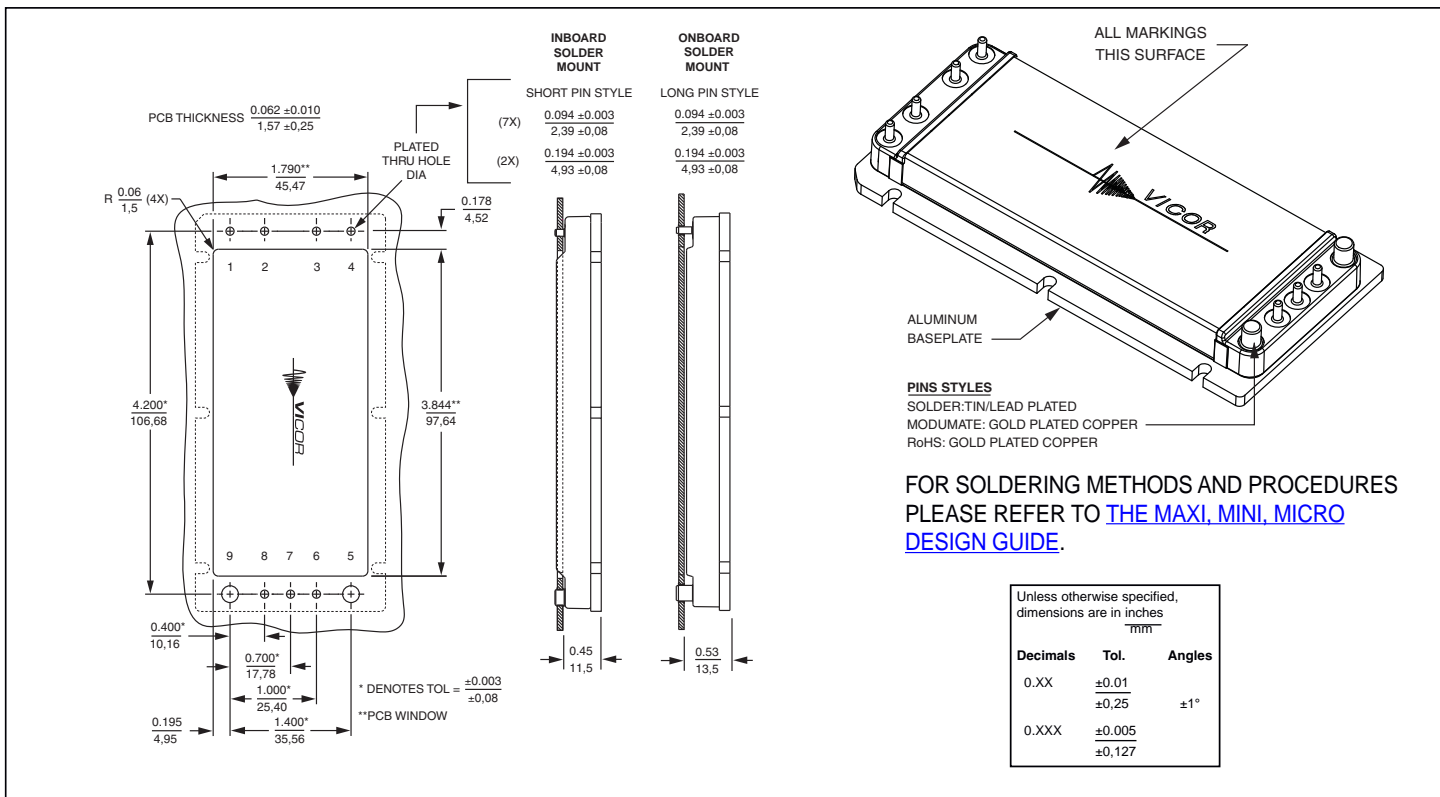


Figure 13 PCB mounting specifications

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