# Data Sheet

# *FasTrak Micro E-Grade Family*

## DC-DC Converter Module

### Features

- Input voltages: 24, 48, 300 & 375 V
- DC outputs: 3.3 V – 48 V
- Programmable output: 10 to 110%
- Regulation: ±0.5% no load to full load
- Efficiency: Up to 88%
- Max operating temp: 100°C, full load
- Power Density: Up to 90 W/cubic Inch
- Parallelable, with N+M fault tolerance
- Low noise ZCS/ZVS architecture

### Product Overview

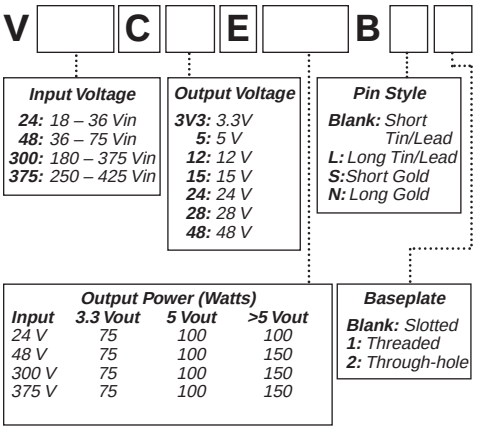
These DC-DC converter modules use advanced power processing, control and packaging technologies to provide the performance, flexibility, reliability and cost effectiveness of a mature power component. High frequency ZCS/ZVS switching provide high power density with low noise and high efficiency.

### Applications

Off-line systems with autoranging or PFC front-ends, industrial and process control, distributed power, medical, ATE, communications, defense, aerospace

### Part Numbering

e.g. V300C12E150BL2




For a description of pin options, see page 6. Baseplate options include slotted flanges, threaded and through-hole. See page 7 for dimensions. For other package sizes and powerlevels, see the FasTrak Maxi (full size) and FasTrak Micro (quarter size) datasheets.




Shown actual size:
2.28 x 1.45 x 0.5 in
57,9 x 36,8 x 12,7 mm

### Absolute Maximum Ratings

| Parameter | Rating | Unit | Notes |
|---|---|---|---|
| +In to –In voltage | | | |
| 24 Vin | -0.5 to +36 | Vdc | |
| 48 Vin | -0.5 to +75 | Vdc | |
| 300 Vin | -0.5 to +375 | Vdc | |
| 375 Vin | -0.5 to +425 | 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 | |
| Isolation voltage (in to out) | 3000 | Vrms | |
| Isolation voltage (in to base) | 1550 | Vrms | |
| Isolation voltage (out to base) | 500 | Vrms | |
| Operating temperature | -10 to +100 | °C | |
| Storage temperature | -20 to +125 | °C | |
| Pin soldering temperature | 500 (260) | °F (°C) | <5 sec; wave solder |
| Pin soldering temperature | 750 (390) | °F (°C) | <7 sec; hand solder |
| Mounting torque | 5 (0.57) | in-lbs (N-m) | 6 each, # 4-40 or M3 |

### Thermal Resistance and Capacity

| Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Baseplate to sink; flat, greased surface | | 0.24 | | °C/Watt |
| Baseplate to sink; thermal pad (P/N 20263) | | 0.21 | | °C/Watt |
| Baseplate to ambient | | 10.9 | | °C/Watt |
| Baseplate to ambient; 1000 LFM | | 2.8 | | °C/Watt |
| Thermal capacity | | 48 | | Watt-sec/°C |



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## 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 OPERATING SPECIFICATIONS

| Parameter | Min | Typ | Max | Surge Withstand | Unit | Notes |
|---|---|---|---|---|---|---|
| Input voltage | | | | | | |
| 24 Vin | 18 | 24 | 36 | 50 | Vdc | <100 ms surge withstand |
| 48 Vin | 36 | 48 | 75 | 100 | Vdc | |
| 300 Vin | 180 | 300 | 375 | 400 | Vdc | |
| 375 Vin | 250 | 375 | 425 | 500 | Vdc | |
| Output voltage setpoint | | | ±1 | | % | Nominal input; full load; 25°C |

### MODULE OUTPUT VOLTAGE RELATED SPECIFICATIONS

| Parameter | 3.3V | 5V | 12V | 15V | 24V | 28V | 48V | Unit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Efficiency (typ.) | 76.5 | 80.0 | 84.0 | 85.5 | 86.0 | 86.5 | 88.0 | % | Nominal input; 80% load; 25°C |
| Ripple and noise, p-p (typ.) | 120 | 105 | 170 | 150 | 150 | 180 | 55 | mV | Nominal input; full load; 25°C; 20MHz BW |
| Output OVP setpoint (nom.) | 4.3 | 6.3 | 14.3 | 17.8 | 28.1 | 32.7 | 55.7 | Volts | 25°C; recycle input voltage to restart ( 1 minute off ) |
| Dissipation, standby (typ.) | 3.4 | 4.4 | 5.0 | 7.0 | 4.9 | 4.6 | 4.0 | Watts | No load; nominal input |
| Load regulation (max.) | 0.4 | 0.4 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | ±% Vout | No load to full load; nominal input |
| Current limit (typ.) | 115 | 115 | 115 | 115 | 115 | 115 | 115 | % Iout | Output voltage 95% of nominal |
| Short circuit current (typ.) | 115 | 115 | 115 | 115 | 115 | 115 | 115 | % Iout. | Output voltage <250mV |

### MODULE INPUT SPECIFICATIONS

| Parameter | 24 Vin | 48 Vin | 300 Vin | 375 Vin | Units | Notes |
|---|---|---|---|---|---|---|
| Undervoltage turn-on | 17.5 | 34.9 | 175 | 243 | Vdc | Typical value |
| Undervoltage turn-off | 15.3 | 30.5 | 153 | 212 | Vdc | Typical value |
| Overvoltage turn-off/on | 37.8 | 78.8 | N/A | 446 | Vdc | Typical value |

**Note:** 300 Vin models do not have overvoltage turn-off.

### MODULE OUTPUT SPECIFICATIONS

| Parameter | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|
| Line regulation | | ±0.5 | | % | Low line to high line; full load |
| Temperature regulation | | ±0.005 | | % / °C | Over operating temperature range |
| Power sharing accuracy | | ±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. |

**Note:** For important information relative to applications where the converter modules are subject to continuous dynamic loading, contact Vicor applications engineering at 800-927-9474.



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## 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 |
| current limit | 1.5 | 2.1 | 3.0 | mA | PC voltage = 5.5V |
| PC module disable | 2.3 | 2.6 | 2.9 | Vdc | Must be able to sink ≥4 mA. See Fig. 1 |
| PC module enable delay | | 4 | 7 | ms | |
| PC module alarm | | | 0.5 | Vavg | UV, OV, OT, module fault. See Figs. 2 and 4 |
| PR emitter amplitude | 5.7 | 5.9 | 6.1 | Volts | PR load >30 ohms, < 30 pF |
| PR emitter current | 150 | | | mA | |
| PR receiver impedance | 375 | 500 | 625 | ohms | 25°C |
| PR receiver threshold | 2.4 | 2.5 | 2.6 | Volts | Minimum pulse width: 20ns |
| 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 –Out |
| SC resistance | 990 | 1000 | 1010 | ohms | |
| SC capacitance | | 0.033 | | µF | |
| SC module alarm | | 0 | | Vdc | With open trim; referenced to –Out. See Fig. 6 |

## MODULE GENERAL SPECIFICATIONS

| Parameter | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|
| Isolation voltage (in to out) | 3000 | | | Vrms | Complies with reinforced insulation requirements |
| Isolation voltage (in to base) | 1550 | | | Vrms | Complies with basic insulation requirements |
| Isolation voltage (out to base) | 500 | | | Vrms | Complies with operational insulation requirements |
| Isolation resistance (in to out) | | 10 | | megohms | |
| Weight | | 2.1 (60) | 2.3(66) | ounces (grams) | |
| Temperature limiting | 100 | 115 | | °C | See Figs. 2 and 4 |
| Agency approvals | | cULus, TÜV, CE | | | UL60950, CSA0950, EN60950, IEC60950. With a fuse in series with the +Input |

***Note:***
Specifications are subject to change without notice.
The latest data sheets for individual models are available on the Vicor website at vicorpower.com.



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## CONTROL FUNCTIONS - PC PIN

### Module Enable/Disable

The module may be disabled by pulling PC below 2.3V with respect to the –Input. This may be done with an open collector transistor, relay, or optocoupler. Multiple converters may be disabled with a single transistor or relay either directly or via "OR'ing" diodes. See Figure 1.

### Primary Auxiliary Supply

At 5.7V, PC can source up to 1.5mA. In the example shown in Figure 3, PC powers a module enabled LED.

### Module Alarm

The module contains "watchdog" circuitry which monitors input voltage, operating temperature and internal operating parameters. In the event that any of these parameters are outside of their allowable operating range, the module will shut down and PC will go low. PC will periodically go high and the module will check to see if the fault (as an example, overtemperature) has cleared. If the fault has not been cleared, PC will go low again and the cycle will restart. The SC pin will go low in the event of a fault and return to its normal state after the fault has been cleared. See Figures 2 and 4.

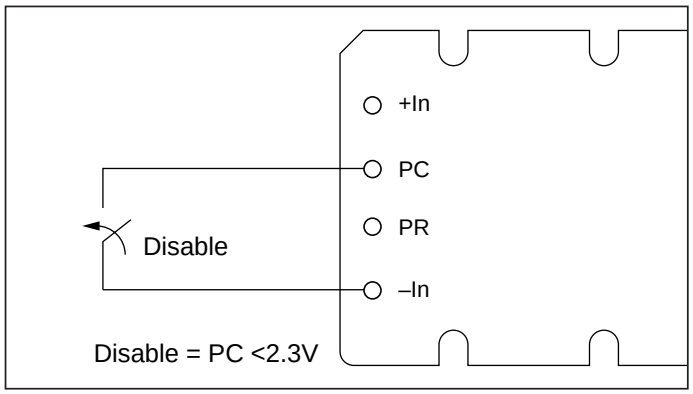



***Figure 1**—Module enable/disable.*

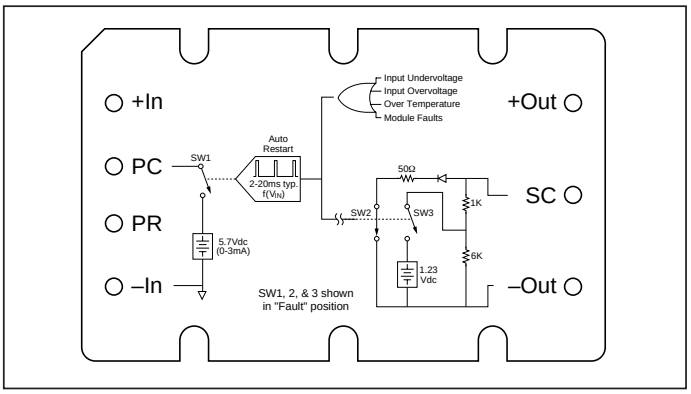



***Figure 2**—PC/SC module alarm logic.*

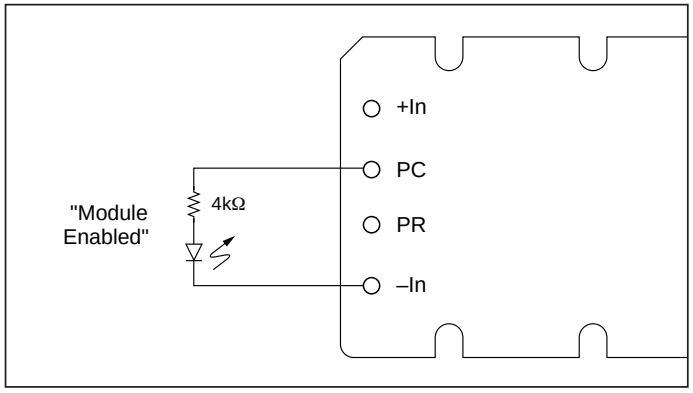



***Figure 3**—LED on-state indicator.*

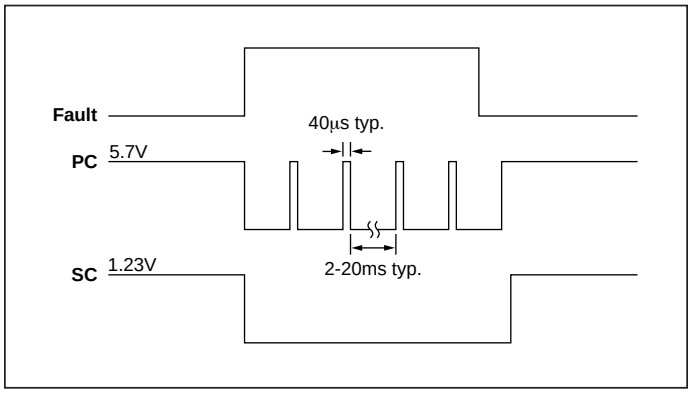



***Figure 4**—PC/SC module alarm timing.*

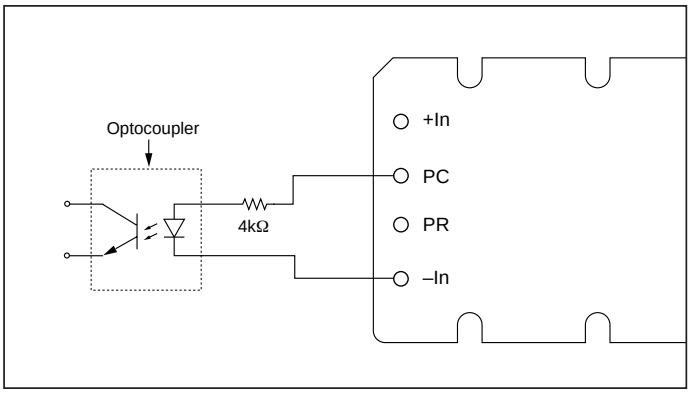



***Figure 5**—Isolated on-state indicator.*

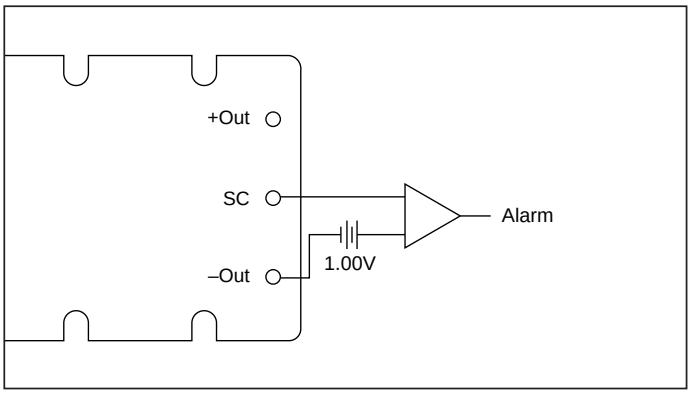



***Figure 6**—Secondary side on-state indicator.*



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### Output Voltage Programming

The output voltage of the converter can be adjusted or programmed via fixed resistors, potentiometers or voltage DACs. See Figures 7 and 8.

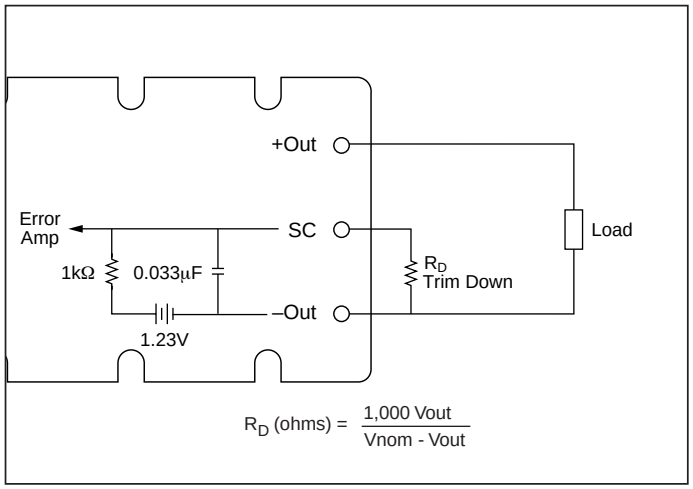



***Figure 7**—Output voltage trim down circuit.*

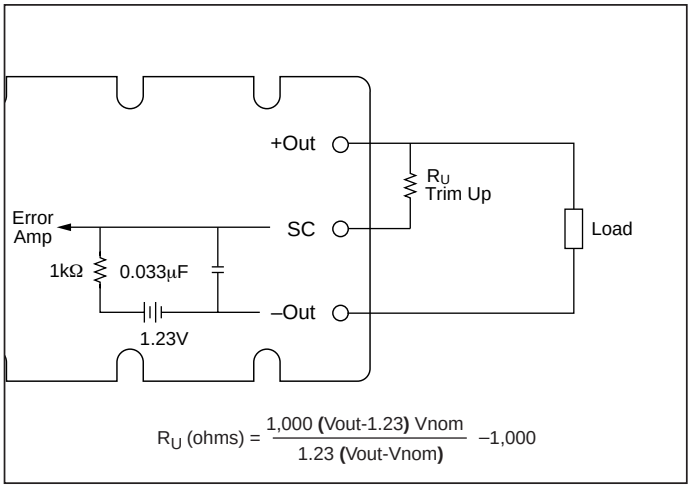


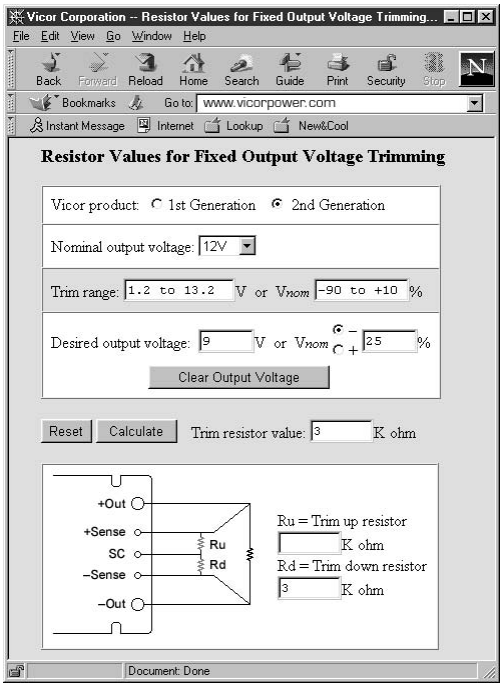

***Figure 8**—Output voltage trim up circuit.*

### Trim Down

1. This converter is <u>not</u> a 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 to the –Out pin.

### 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 to the +Out pin.
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: vicorpower.com/tools.html.

Resistor values can be calculated for fixed trim up, fixed trim down and for variable trim up or down cases for both 1st and 2nd Generation DC-DC converters.

In addition to trimming information, the web site and the Applications Manual also include design tips, applications circuits, EMC suggestions, thermal design guidelines and PDF data sheets for all available Vicor products.

### Parallel Operation

The PR pin supports paralleling for increased power with N+1 (N+M) redundancy and phased array capability. 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:

*DC coupled single-wire interface*. All PR pins are directly connected to one another. This interface supports current sharing but is not fault tolerant. Minus In pins must be tied to the same electric potential. See Figure 9.

*AC coupled single-wire interface*. All PR pins are connected to a single communication bus through 0.001µF (500V) capacitors. This interface supports current sharing and is fault tolerant except for the communication bus. See Figure 10.

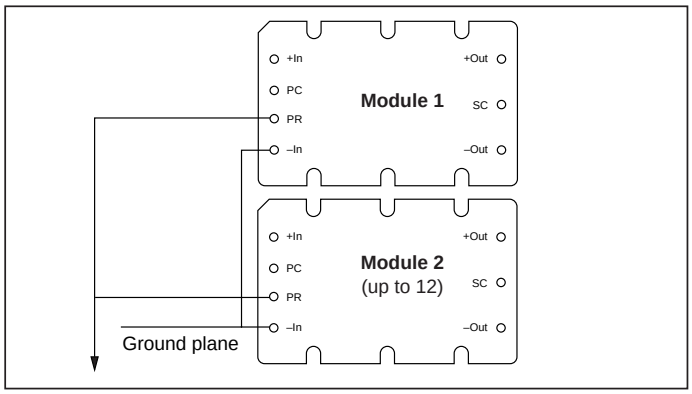



***Figure 9**—DC coupled single-wire interface.*

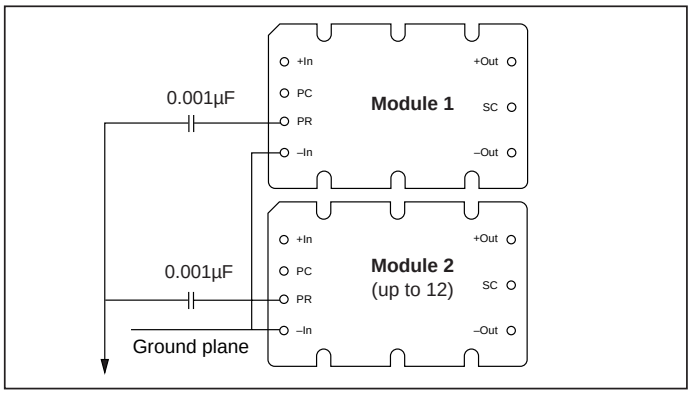



***Figure 10**—AC coupled single-wire interface.*

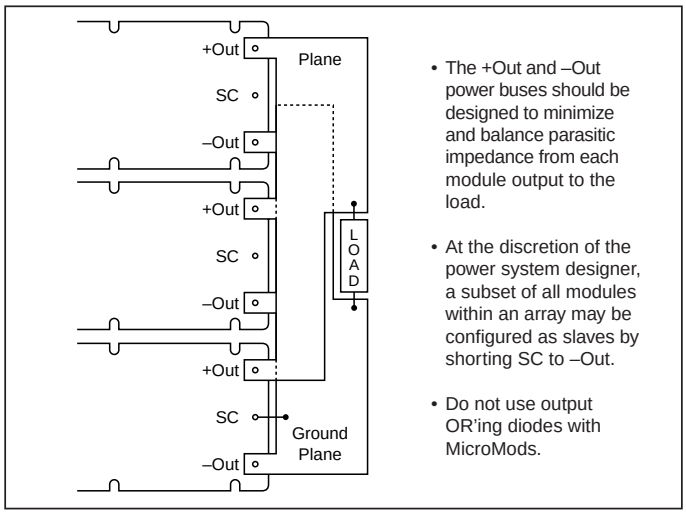



***Figure 11**—N+1 module array output connections.*

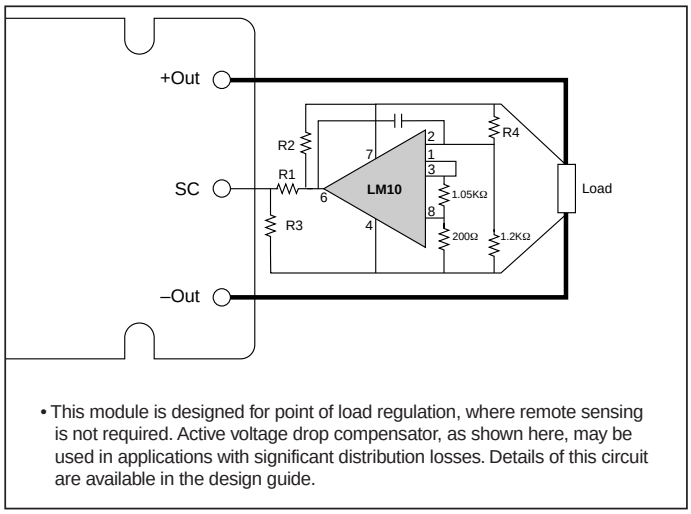



***Figure 12**—Voltage drop compensation.*

### PIN STYLES *

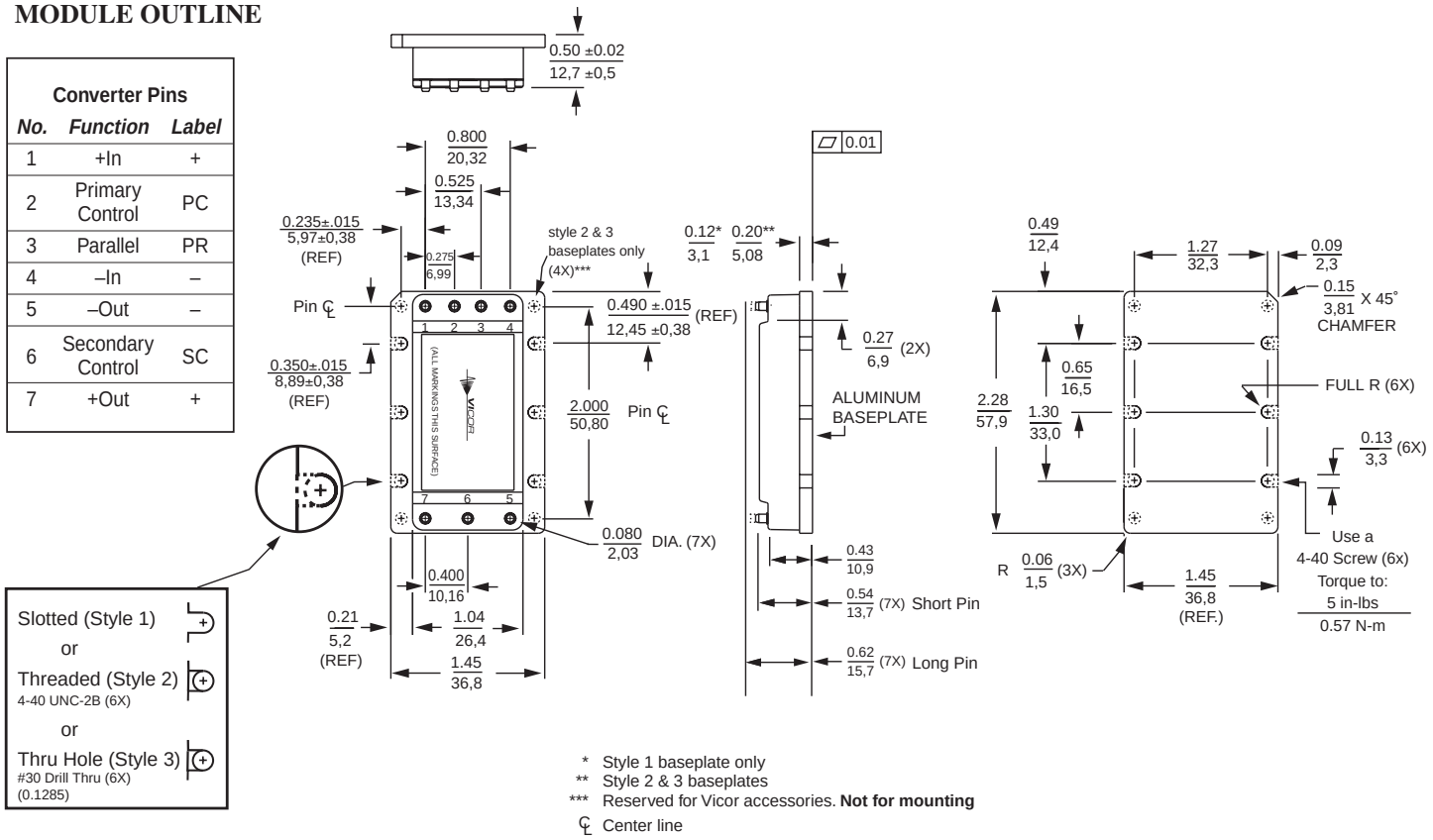
| Designator | Description | Notes |
|---|---|---|
| (None) | Short solder | Requires in-board, mounting |
| L | Long solder | On-board mounting for 0.065" boards |
| S | Short ModuMate | SurfMate or in-board socket mounting – RoHS compliant |
| N | Long ModuMate | On-board socket mounting – RoHS compliant |

* *Pin style designator follows the "B" after the output power and precedes the baseplate designator.*
*Ex. V375A24C600BN — Long ModuMate Pins*

# MECHANICAL DRAWINGS

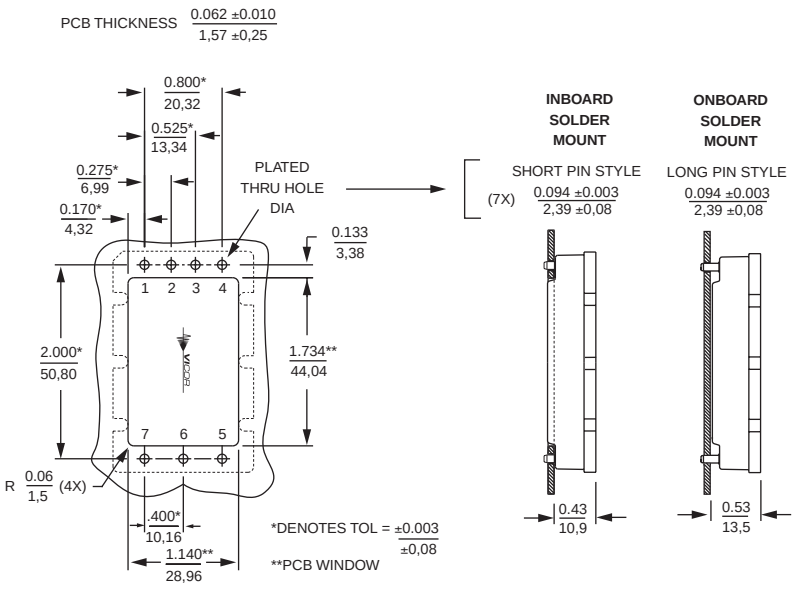
## MODULE OUTLINE

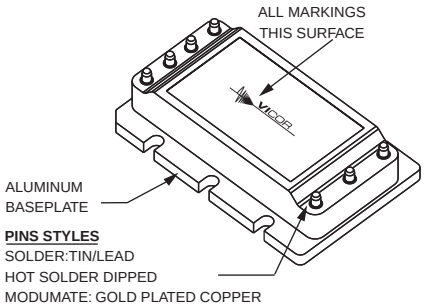
| Converter Pins | | |
|---|---|---|
| *No.* | *Function* | *Label* |
| 1 | +In | + |
| 2 | Primary Control | PC |
| 3 | Parallel | PR |
| 4 | –In | – |
| 5 | –Out | – |
| 6 | Secondary Control | SC |
| 7 | +Out | + |




* Style 1 baseplate only
** Style 2 & 3 baseplates
*** Reserved for Vicor accessories. **Not for mounting**
℄ Center line

## PCB MOUNTING SPECIFICATIONS




| Unless otherwise specified, dimensions are in inches / mm | | |
|---|---|---|
| **Decimals** | **Tol.** | **Angles** |
| 0.XX | ±0.01 / ±0.25 | ±1° |
| 0.XXX | ±0.005 / ±0.127 | |




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