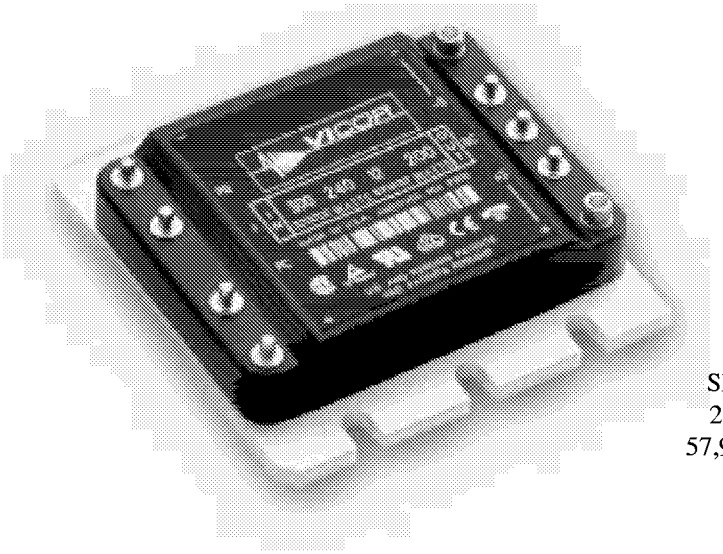
Data Sheet
*48V Input Mini Family**
DC-DC Converter Module

Features

- DC input range: 36 - 75V
- Input surge withstand: 100V for 100ms
- DC output: 2V - 48V
- Programmable output: 10 to 110%
- Regulation: ±0.2% no load to full load
- Efficiency: Up to 91%
- Maximum operating temperature: 100°C at full load
- Power density: Up to 100W/cubic inch
- Height above board: 0.43 in. (10,9 mm)
- Parallelable, with N+M fault tolerance
- Low noise ZCS/ZVS architecture

Typical Applications: telecommunications and distributed power systems

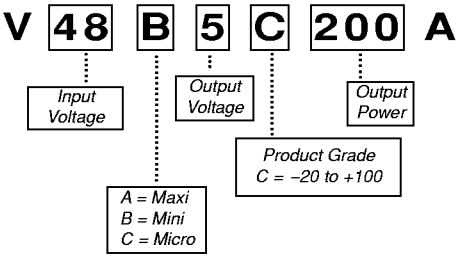


Shown actual size:
2.28 x 2.2 x 0.5 in
57,9 x 55,9 x 12,7 mm

Product Overview

This DC-DC converter module uses second generation power processing, control and packaging technologies to provide the performance, flexibility and cost effectiveness expected of a mature Power Component. For example, a plated-cavity core couples widely separated primary and secondary windings, resulting in low in-to-out parasitic capacitance and noise.
High frequency ZCS/ZVS switching, advanced power semiconductor packaging and thermal management provide high power density with low temperature gradients. Extensive use of silicon integration results in 1/3 the part count of a first generation converter.

Part Numbering



For long pin configuration add "L" to the end of the part number. *See page 7 for pin dimensions.*

Absolute Maximum Ratings

Parameter	Rating	Unit	Notes
+In to –In voltage	-0.5 to +75	Vdc	
+In to –In voltage	100	Vdc	<100ms
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	
Isolation voltage (in to out)	3000	V rms	
Isolation voltage (in to base)	1550	V rms	
Isolation voltage (out to base)	500	V rms	
Storage temperature	-40 to +125	°C	
Operating temperature	-20 to +100	°C	Baseplate
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 (.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		0.16		°C/Watt
Baseplate to sink; thermal pad (P/N 16495)		0.2		°C/Watt
Baseplate to ambient		9.8		°C/Watt
Baseplate to ambient; 1000 LFM		2.2		°C/Watt
Thermal capacity		83		Watt-sec/°C

* The modules described here are the highest power for each output voltage. Consult factory for availability of lower power units.

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	Unit	Notes
Operating input voltage	36	48	75	Vdc	
Input surge withstand			100	Vdc	<100ms
Output voltage setpoint			±1%	Vout nom.	Nominal input; full load; 25°C

■ MODULE INPUT SPECIFICATIONS

Parameter	2V	3.3V	5V	12V	15V	24V	28V	48V	Unit	Notes
Efficiency (typ.)	73.0	79.5	83.0	86.0	87.5	88.5	88.5	89.5	%	Nominal input; 80% load; 25°C
Ripple and noise, p-p (typ.)	85	60	80	160	115	125	75	80	mV	Nominal input; full load; 25°C; 20MHz BW
Output Power (max.)	100	150	200	250	250	250	250	250	Watts	
Output OVP setpoint (nom.)	2.8	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.)	4.3	3.5	3.3	4.4	5.3	5.0	4.5	3.9	Watts	No load; nominal input
Load regulation (max.)	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	±% Vout	No load to full load; nominal input
Current limit (typ.)	115	115	115	115	115	115	115	115	% Iout max.	Output voltage 95% of nominal
Short circuit current (typ.)	115	115	115	115	115	115	115	115	% Iout max.	Output voltage <250mV

■ MODULE INPUT SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Undervoltage turn-on		34.9	35.7	Vdc	
Undervoltage turn-off	29.4	30.5		Vdc	
Overvoltage turn-off/on	75.7	78.8	82.5	Vdc	

■ MODULE OUTPUT SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Line regulation		±0.02	±0.2	%	Low line to high line; full load
Temperature regulation		±0.002	±0.005	% / °C	-20 to 100°C
Power sharing accuracy		±2	±5	%	10 to 100% of full load
Programming range	10		110	%	Of nominal output voltage. For trim below 90% of nominal, a minimum load of 10% of maximum rated power may be required.

■ MODULE CONTROL SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
PRIMARY SIDE (PC = Primary Control; PR = Parallel)					
PC bias voltage	5.7	5.9	6.1	Vdc	PC current = 1.0 mA
current limit	1.5	2.1	3.0	mA	PC voltage = 5.6V
PC module disable	2.5	2.5	2.6	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, 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	1.22	1.23	1.24	Vdc	Referenced to –Sense
SC resistance	990	1000	1010	Ohms	
SC capacitance		0.033		µF	
SC module alarm		0		Vdc	With open trim; referenced to –Sense. See Fig. 6

■ MODULE GENERAL SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Remote sense (total drop)			0.5	Vdc	0.25V per leg (senses must be closed)
Isolation voltage (in to out)	3000			V rms	Complies with reinforced insulation requirements
Isolation voltage (in to base)	1550			V rms	Complies with basic insulation requirements
Isolation voltage (out to base)	500			V rms	Complies with operational insulation requirements
Isolation resistance (in to out)		10		Megohms	
Weight		3.7 (104)	4 (112)	Ounces (grams)	
Temperature limiting	100	115		°C	See Figs. 2, 4
Agency Approvals	UL, CSA, TÜV, BABT, CE, VDE				UL1950, CSA950, EN60950, VDE0805, BS7002, IEC 60950. 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 www.vicr.com.

CONTROL FUNCTIONS - PC PIN

Module Enable/Disable

The module may be disabled by pulling PC below 2.5V 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 5.9V, 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, 4.

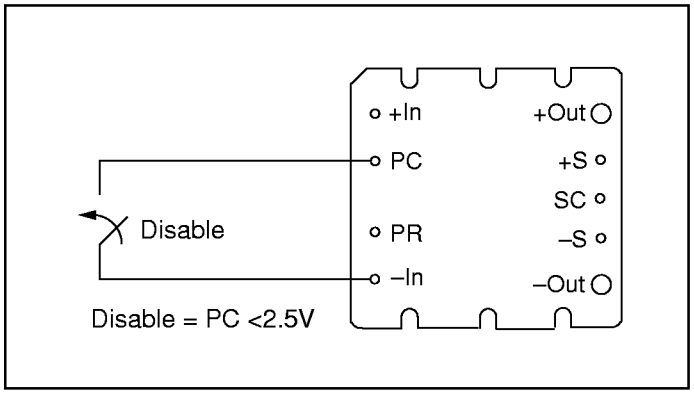


***Figure 1**—Module enable/disable.*

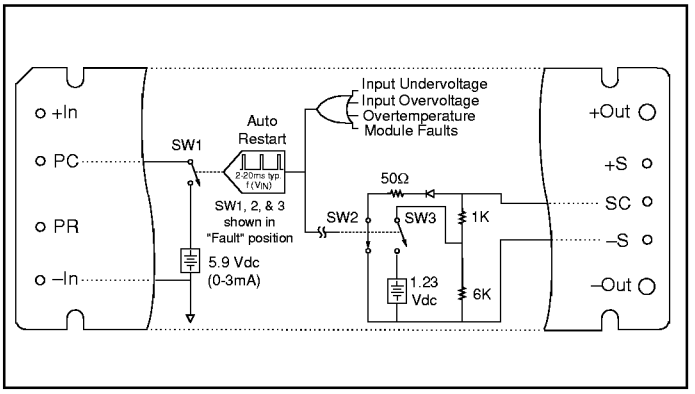


***Figure 2**—PC/SC module alarm logic.*

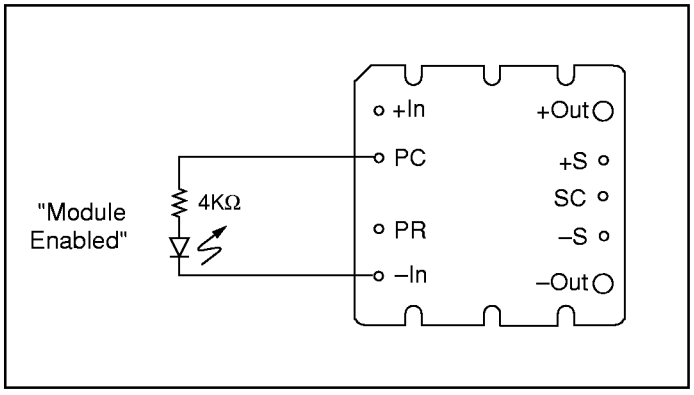


***Figure 3**—LED on-state indicator.*

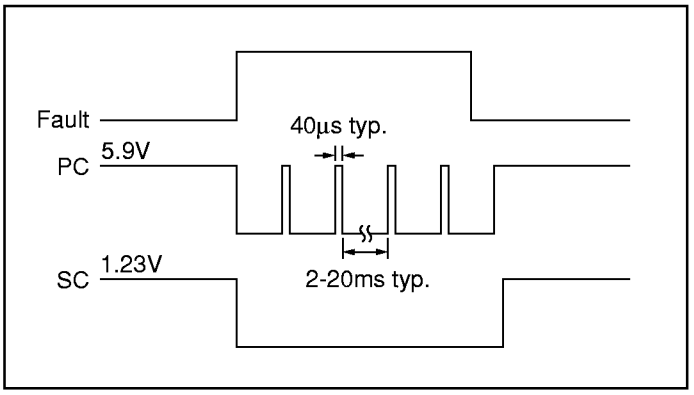


***Figure 4**—PC/SC module alarm timing.*

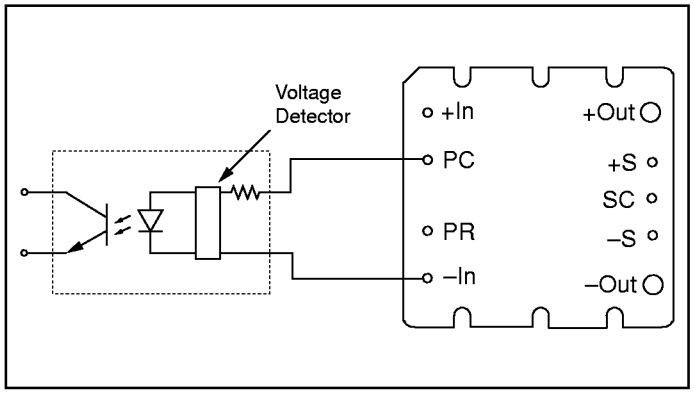


***Figure 5**—Isolated on-state indicator.*

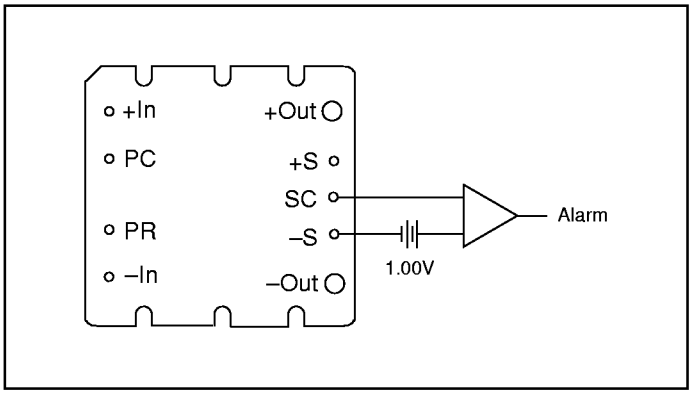


***Figure 6**—Secondary side on-state indicator.*

CONTROL FUNCTIONS - SC PIN

Output Voltage Programming

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

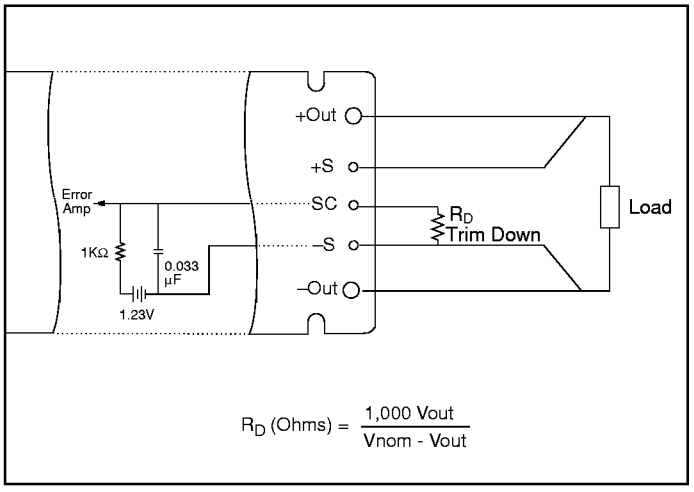


Figure 7*—Output voltage trim down circuit.*

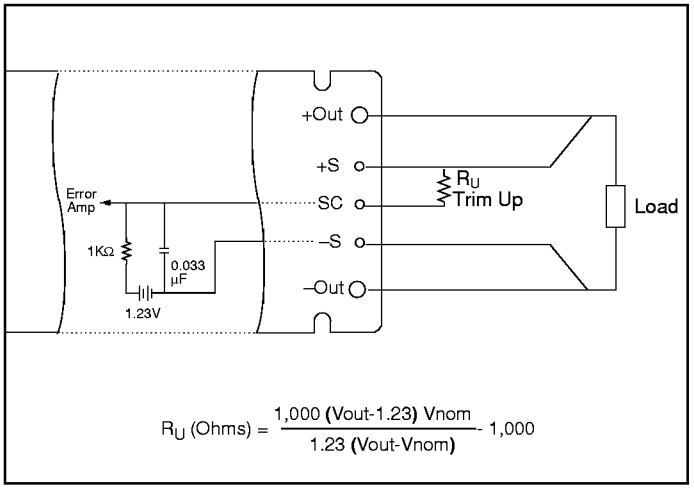


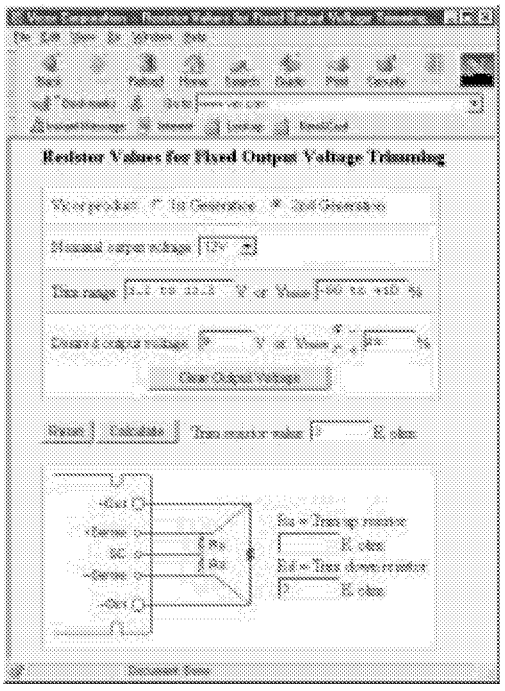
Figure 8*—Output voltage trim up circuit.*

Trim Down

1. This converter is not 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 –Sense 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 +Sense pin.
3. Do not trim the converter above maximum trim range (typically +10%) or the output over voltage protection circuitry may be activated.



Trim values calculated automatically:

Resistor trim calculators are available on Vicor's web site at URL: www.vicr.com/tools.html or by requesting a copy of Vicor's Applications Manual on a CD ROM.

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 on CD ROM 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 .001µF (500V) capacitors. This interface supports current sharing and is fault tolerant except for the communication bus. See Figure 10.

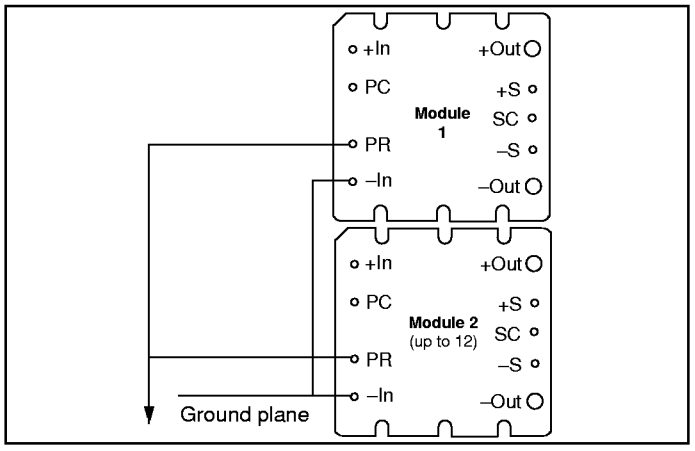


***Figure 9**—DC coupled single-wire interface.*

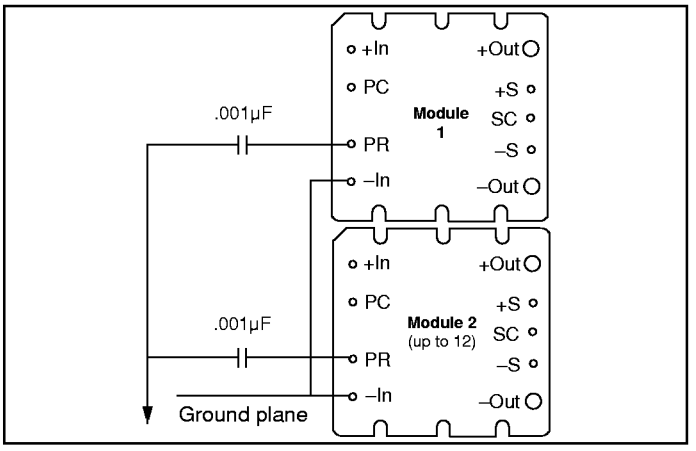


***Figure 10**—AC coupled single-wire interface.*

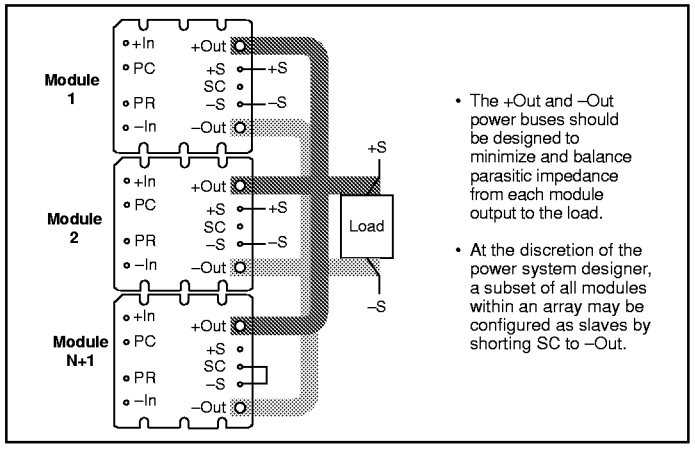


***Figure 11**—N+1 module array output connections.*

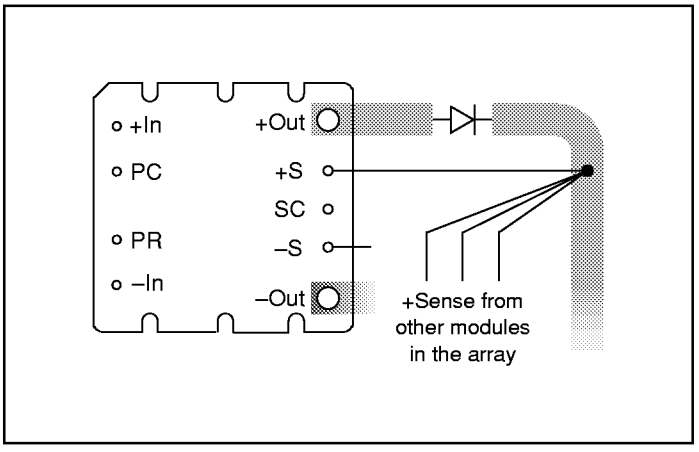
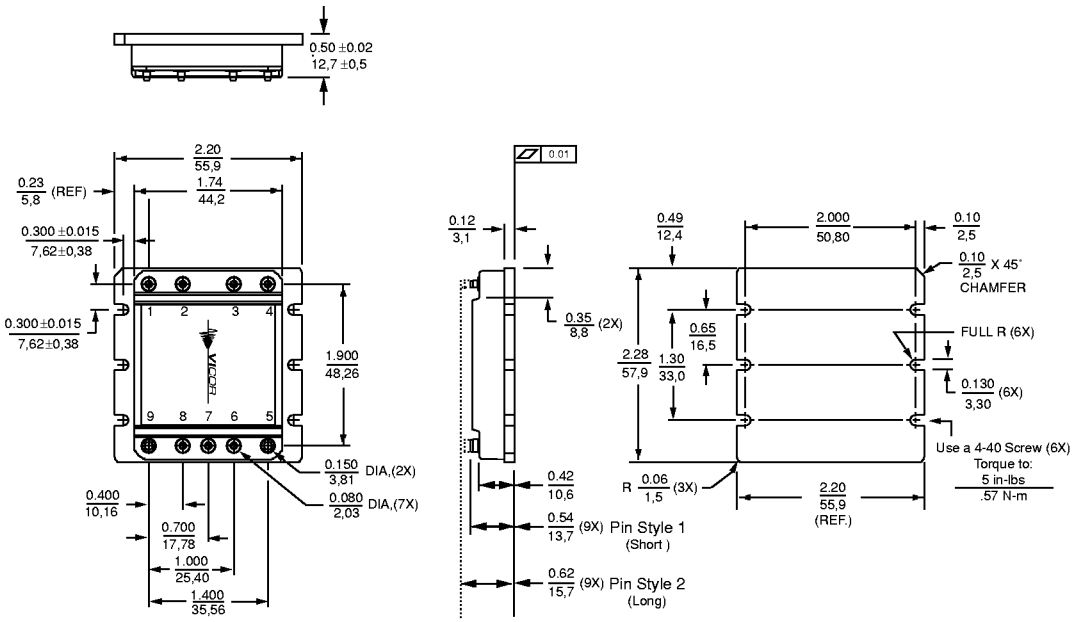


***Figure 12**—OR'ing diodes connections.*

MECHANICAL DRAWINGS

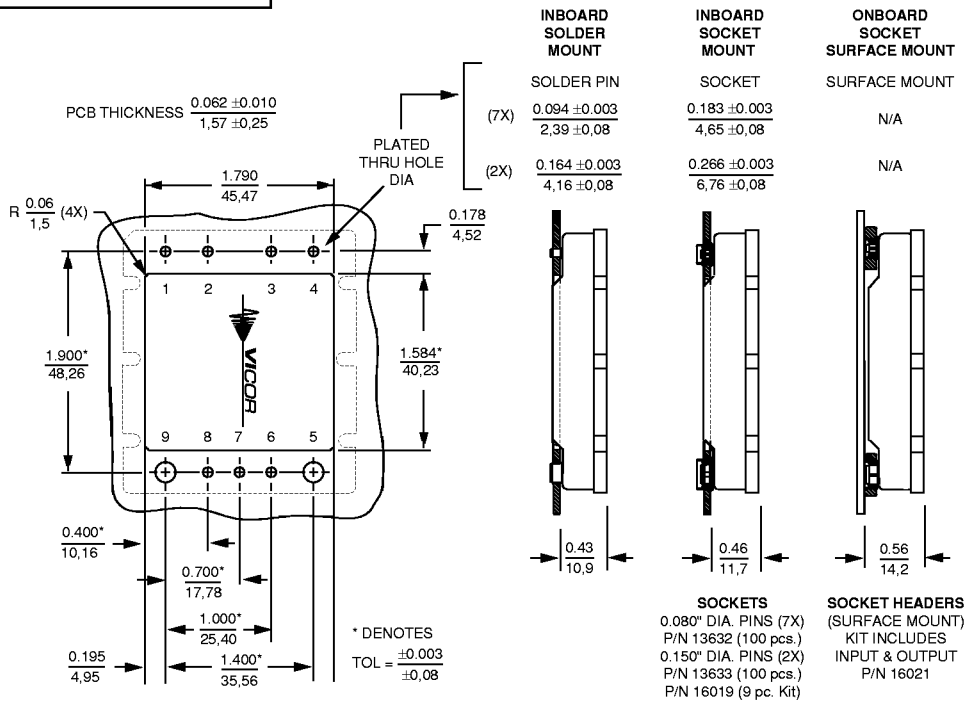
MODULE OUTLINE

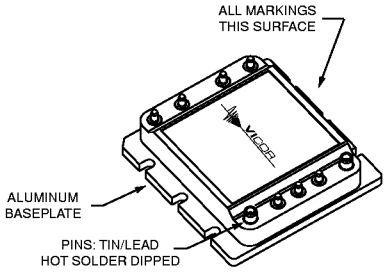
Converter Pins		
No.	*Function*	*Label*
1	+In	+
2	Primary Control	PC
3	Parallel	PR
4	–In	–
5	–Out	–
6	–Sense	–S
7	Secondary Control	SC
8	+Sense	+S
9	+Out	+



PCB MOUNTING SPECIFICATIONS (PIN STYLE 1)

Refer to Drawing 18569 for Pin Style #2 and other Mounting Options





Unless otherwise specified, dimensions are in inches / mm

Decimals	Tol.	Angles
0.XX	±0.01 / ±0.25	±1°
0.XXX	±0.005 / ±0.127	

Vicor's comprehensive line of power solutions includes modular, high density DC-DC converters and accessory components, configurable power supplies, and custom power systems.

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