DC-DC Converter Module
VE-820005B

Mini – 300 Vin / 28 Vout / 200 Watts

Features

- DC input range: 180 - 450 V
- Input surge withstand: 525 V for 100 ms
- DC output: 28 V
- Programmable output: 10 to 110%
- Regulation: ±0.2% no load to full load
- Efficiency: 86.8%
- Maximum operating temperature: 100°C at full load
- Height above board: 0.43 in. (10,9 mm)
- Parallelable, with N+M fault tolerance
- Low noise ZCS/ZVS architecture
- Pin style: FALSE
- Baseplate: FALSE

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 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.

Absolute Maximum Ratings

Parameter	Rating	Unit	Notes
+In to –In voltage	-0.5 to +551	Vdc	
+In to –In voltage	525	Vdc	<100 ms
PC to –In voltage	-0.5 to +7	Vdc	
PR to –In voltage	-0.5 to 7	Vdc	
+Out to –Out voltage	-0.5 to + 36.9	Vdc	
+Sense to –Out voltage	-0.5 to 36.9	Vdc	
–Sense to –Out voltage	1.0	Vdc	
SC to –Out voltage	-0.5 to +1.5	Vdc	
Isolation voltage			
in to out	3000	Vrms	Test voltage
in to base	1550	Vrms	Test voltage
out to base	500	Vrms	Test voltage
Storage temperature	-40 to +125	°C	
Operating temperature	-40 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 (0.57)	in-lbs (N-m)	6 each, # 4-40 or M3

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	180	300	450	Vdc	
Input surge withstand			525	Vdc	<100 ms
Output voltage setpoint	27.72	28	28.28	Vdc	Nominal input; full load; 25°C
Output OVP setpoint	31.5	32.7	33.9	Vdc	25°C; recycle input voltage to restart (100 ms off)
Output power			200	Watts	At 100°C baseplate temperature
Efficiency	85.8	86.8		%	Nominal input; 75% of full load; 25°C

MODULE INPUT SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Undervoltage turn-on		174.6	178.2	Vdc	
Undervoltage turn-off	147.4	152.8		Vdc	
Overvoltage turn-off	454.4	472.5	495	Vdc	
Dissipation, standby		7.1	9	Watts	No load

MODULE OUTPUT SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Line regulation		±0.02	±0.2	%	Low line to high line; full load
Load regulation		±0.02	±0.2	%	No load to full load; nominal input
Temperature regulation		±0.002	±0.005	% / °C	-20 to 100°C
Ripple and noise, p-p		240	300	mV	Nominal input; full load; 20 MHz bandwidth
Load current	0		7.14	Amps	
Current limit	7.28	8.21	9.64	Amps	Output voltage 95% of nominal
Short circuit current	4.99	8.21	9.64	Amps	Output voltage <250 mV
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.

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.

ELECTRICAL CHARACTERISTICS, CONT.

THERMAL RESISTANCE AND CAPACITY

Parameter	Min	Typ	Max	Unit	Notes
Baseplate to sink; flat, greased surface		0.16		°C/Watt	
Baseplate to sink; thermal pad (P/N 20264)		0.14		°C/Watt	
Baseplate to ambient		8.0		°C/Watt	
Baseplate to ambient; 1000 LFM		1.9		°C/Watt	
Thermal capacity		83		Watt-sec/°C	

MODULE CONTROL SPECIFICATIONS

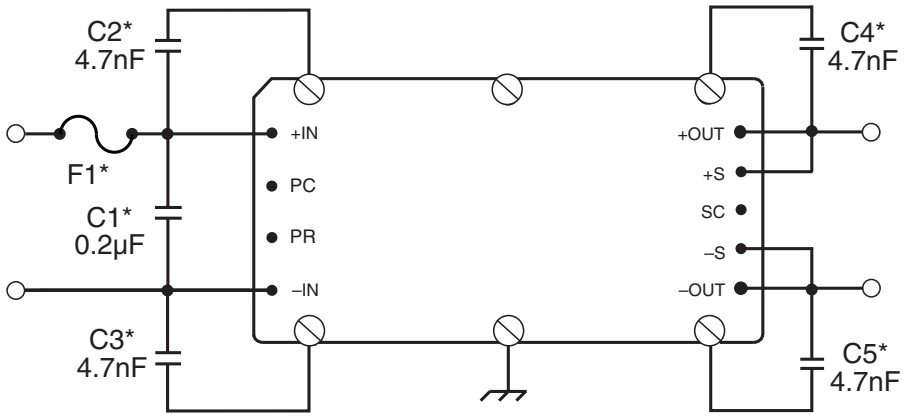
Parameter	Min	Typ	Max	Unit	Notes
PRIMARY SIDE (PC = Primary Control; PR = Parallel)					
PC bias voltage	5.50	5.75	6.10	Vdc	PC current = 1.0 mA
current limit	1.5	2.1	3	mA	PC voltage = 5.5 V
PC module disable	2.3	2.6	2.9	Vdc	Must be able to sink ≥4 mA. See Fig. 2
PC module enable delay		4	7	ms	
PC module alarm			0.5	Vavg	UV, OV, OT, module fault. See Figs. 3 and 5
PC resistance	0.9	1.0	1.1	MΩ	See Fig. 3
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	Ω	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 –Sense
SC resistance	990	1000	1010	Ω	
SC capacitance		0.033		µF	
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 (senses must be closed)
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		MΩ	
Weight		3.7 (104)	4 (112)	ounces (grams)	
Temperature limiting	100	115		°C	See Figs. 3 and 5, Temperature limiting disabled

Agency approvals

BASIC MODULE OPERATION



For C1 – C5, keep leads and connections short.

Figure 1 *— Basic module operation requires fusing, grounding, bypassing capacitors.*
** See Maxi, Mini, Micro Design Guide.*

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, front-ends
- Mounting options

...and more.

CLICK HERE TO VIEW DESIGN GUIDE

Also at vicorpower.com

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

PRIMARY CONTROL - PC PIN

Module Enable/Disable

The module may be disabled by pulling PC to 0 V (2.3 V max) with respect to the –Input. This may be done with an open collector transistor, relay, or optocoupler. Converters may be disabled with a single transistor or relay either directly or via "OR'ing" diodes for 2 or more converters. See Figure 2.

Primary Auxiliary Supply

During normal operation only, the PC Pin can source 5.7 V @ 1.5 mA. In the example shown in Figure 4, PC powers a module enabled LED.

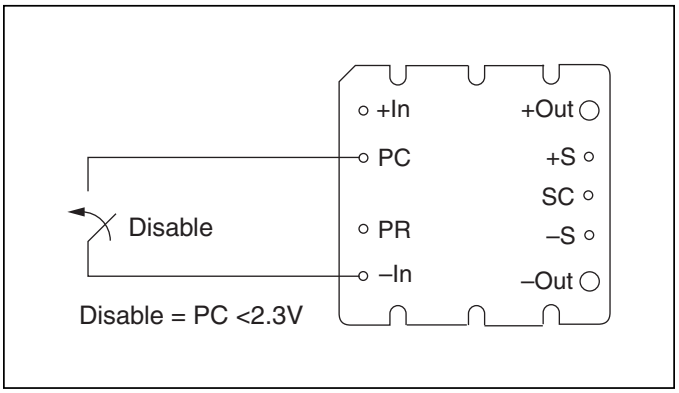


Figure 2 *— Module enable/disable.*

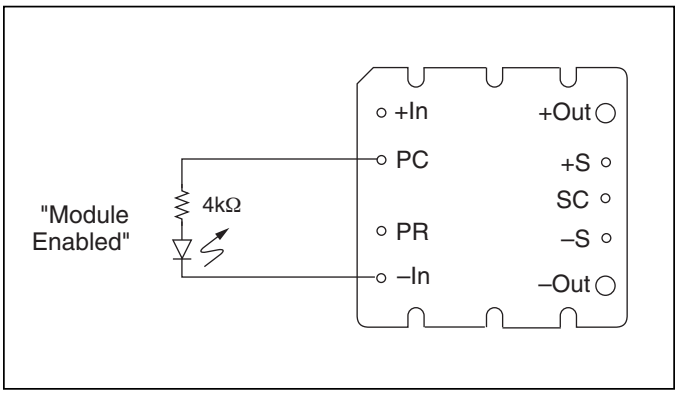


Figure 4 *— LED on-state indicator.*

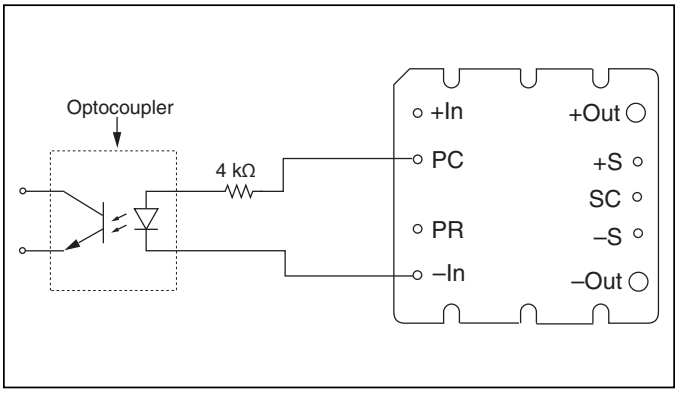


Figure 6 *— Isolated on-state indicator.*

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, Input Undervoltage) 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 3 and 5.

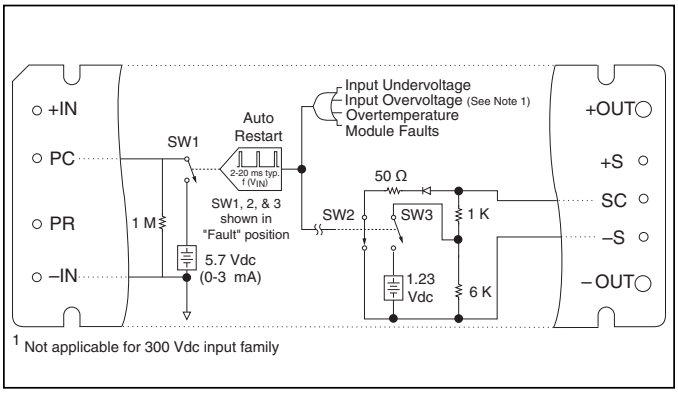


Figure 3 *— PC/SC module alarm logic.*

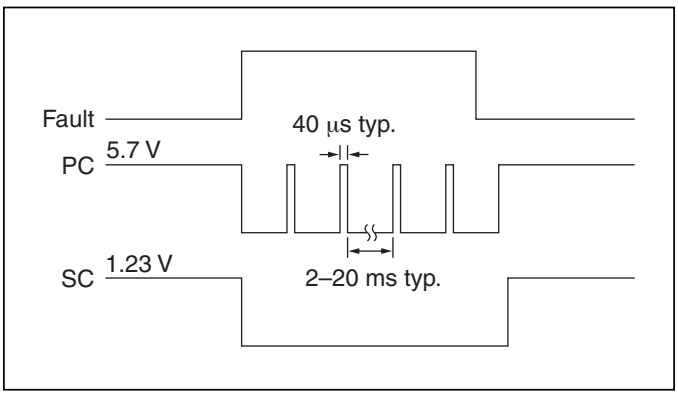


Figure 5 *— PC/SC module alarm timing.*

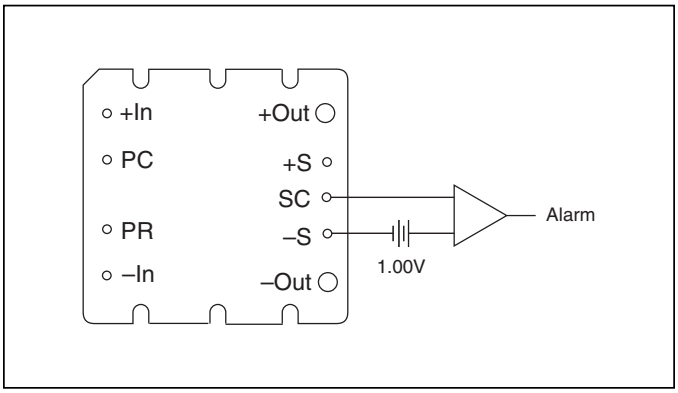


Figure 7 *— Secondary side on-state indicator.*

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.

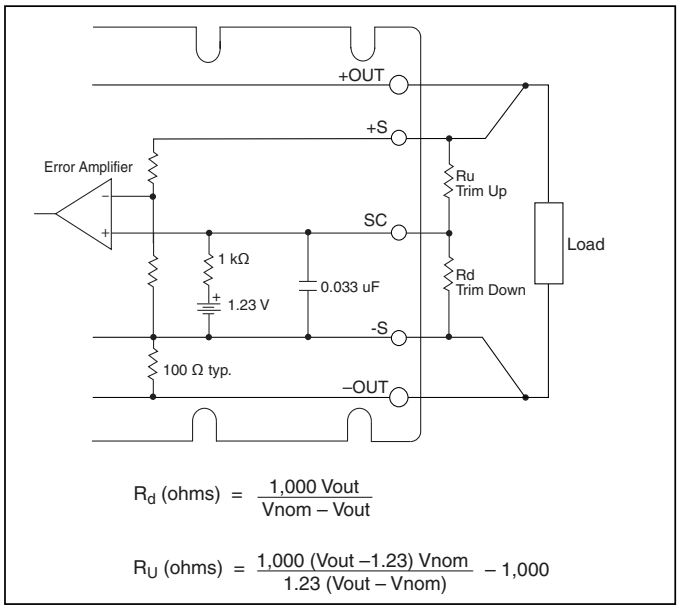


Figure 8 *— Output voltage trim down and trim up circuit.*

Trim Down

1. This converter is not 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 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 µF (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.

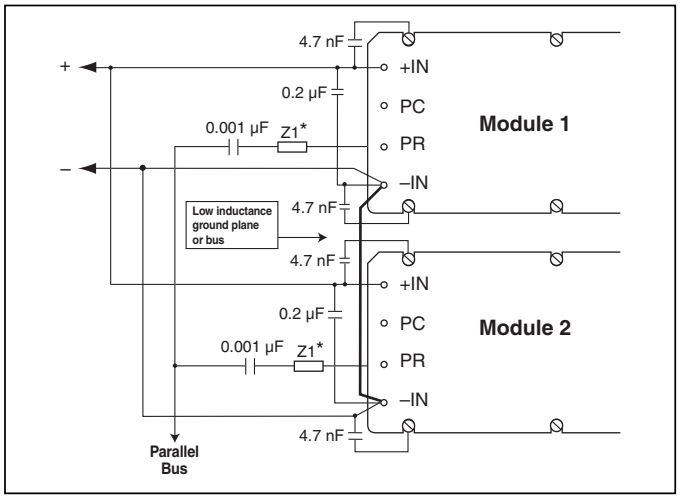


Figure 9 *— AC coupled single-wire interface.*
** See Maxi, Mini, Micro Design Guide.*

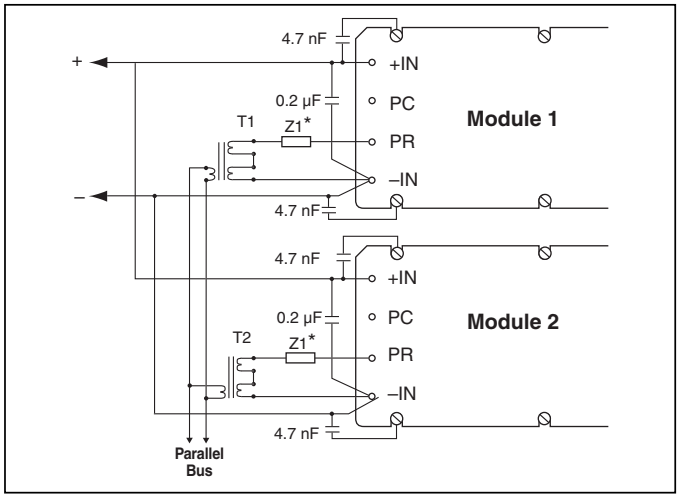
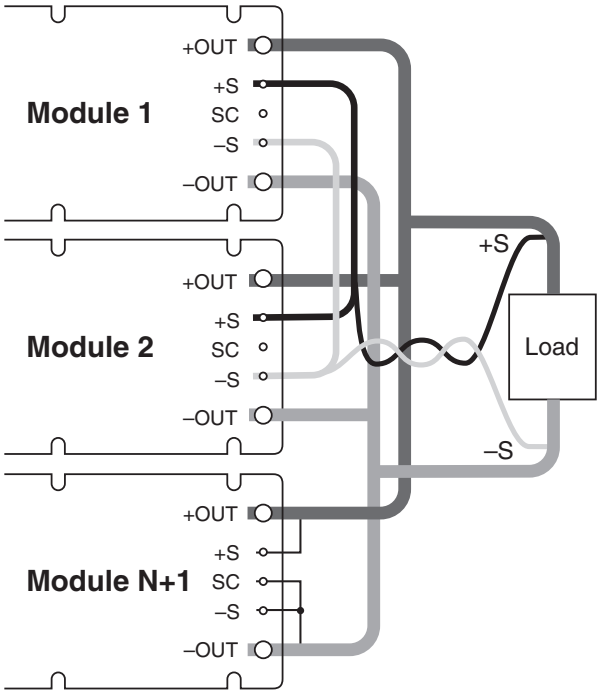


Figure 10 *— Transformer-coupled interface.*

PARALLEL BUS OUTPUT



- The +Out and –Out power buses should be designed to minimize and balance parasitic impedance from each module output to the load.
- The +Sense pins must be tied together to form a +Sense bus. This must be Kelvin connected to +Out at a single point. The –Sense pins should be tied together to form a –Sense bus. This must be Kelvin connected to –Out at a single point.
- At the discretion of the power system designer, a subset of all modules within an array may be configured as slaves by connecting SC to –S.
- OR'ing diodes may be inserted in series with the +Out pins of each module to provide module output fault tolerance.
- The +Sense and -Sense leads should be routed in close proximity to each other on the printed circuit board. If wires are used to connect the converters on a PCB to an external load, the Sense leads should be twisted together to reduce noise pickup.

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

MECHANICAL DRAWINGS

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	+

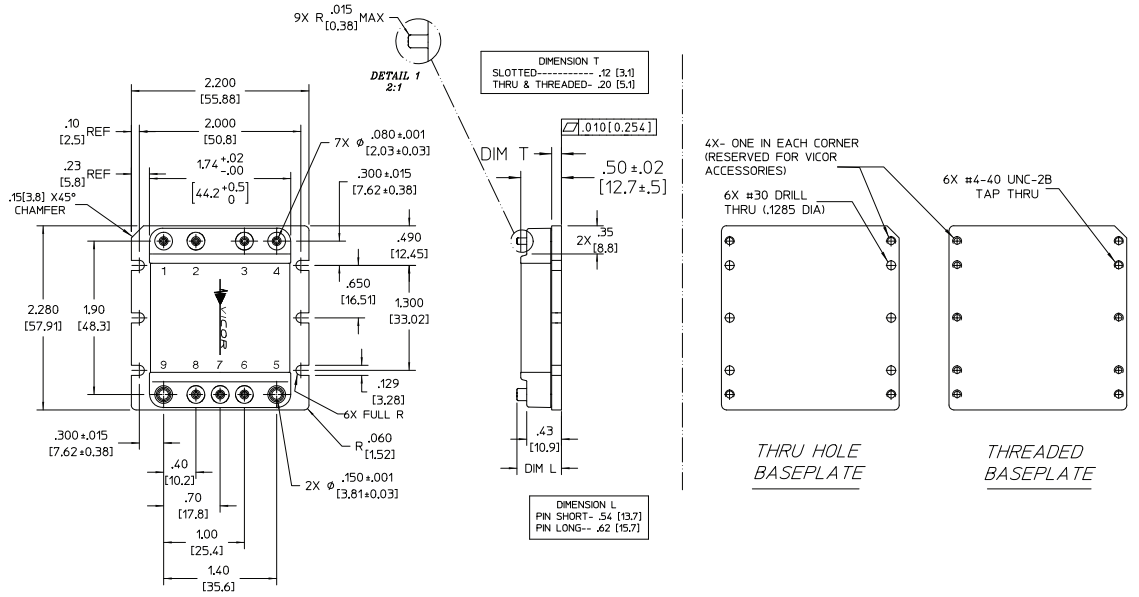


Figure 12 *— Module outline*

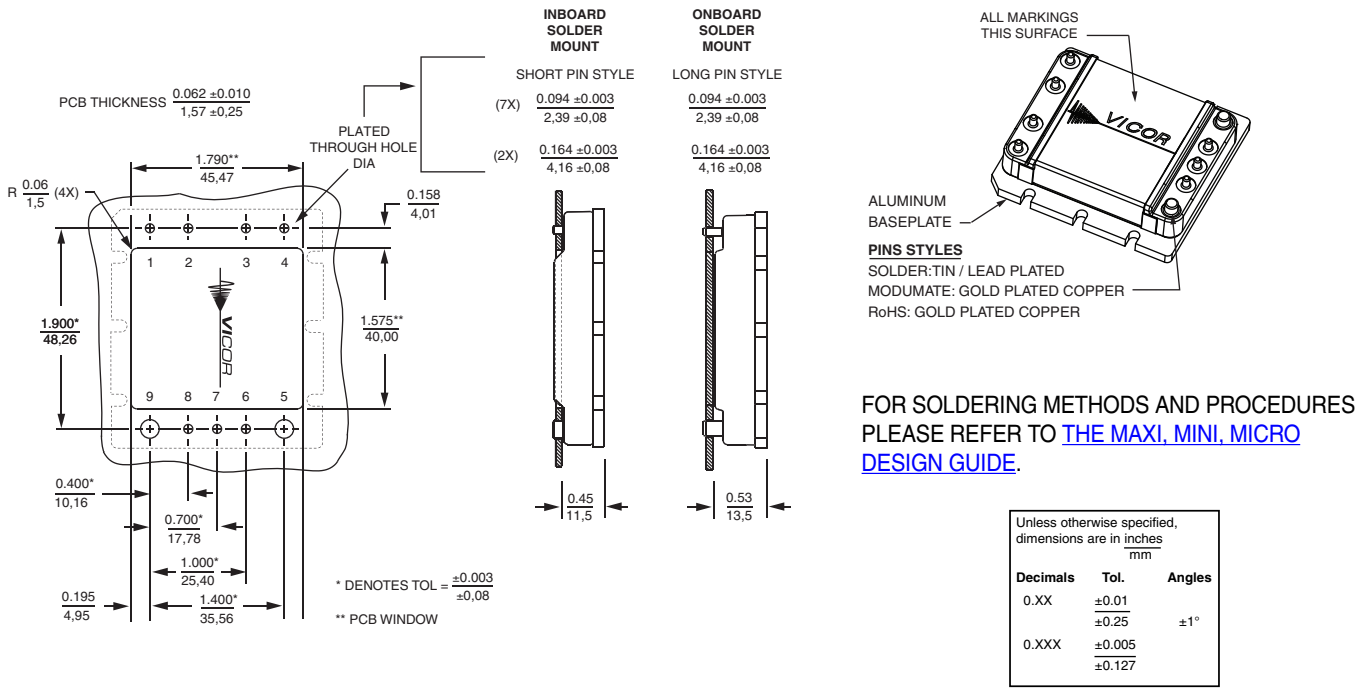


Figure 13 *— PCB mounting specifications*

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