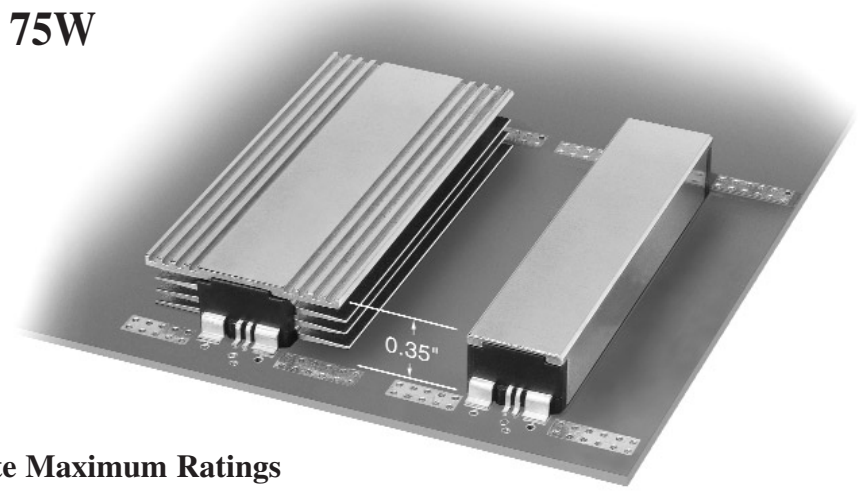
Data Sheet PRELIMINARY

PowerStick™ DC-DC Converters

Low Profile, Integral Cooling
Up to 75W



Features

- DC input range: 36 – 75V
- DC outputs: 1.5 to 12V
- Low profile: 0.350" above board height
- Multiple fin configurations
- Effective power density: Up to 188W/in^3
- Parallelable, with N+M fault tolerance
- Low noise ZCS/ZVS architecture
- Input surge withstand: 100V for 100ms

Typical Applications

Typical applications include communications, data processing, test equipment, industrial applications and distributed power systems.

Product Overview

PowerStick features an above board height of only 0.35" and a footprint as small as 2.28"L x 0.5"W. PowerStick converters deliver up to 75 Watts per module and up to 900 Watts in fault-tolerant arrays.

Vicor's innovative through-the-board mounting results in an effective power conversion density of 188W/in^3. A wraparound aluminum body, available in a variety of options, provides integral cooling in a broad range of applications and thermal environments, allowing customers to achieve peak power density within the 0.35" low profile.

All members of the PowerStick family maintain the complete feature set of Vicor 2nd Generation converters. And, because PowerSticks are environmentally sealed and encased in aluminum, they offer superior ruggedness, reliability, electrical shielding and noise performance.

Low voltage models incorporate Vicor's innovative Smart Rectification™ for high efficiency.

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	
–Sense to –Out voltage	1.0	Vdc	
Isolation voltage (in to out)	1500	Vdc	
Isolation voltage (in to case)	1500	Vdc	
Isolation voltage (out to case)	1500	Vdc	
Storage temperature (C-Grade)	-40 to +125	°C	
Operating temperature (C-Grade)	-20 to +100	°C	Case Temp.

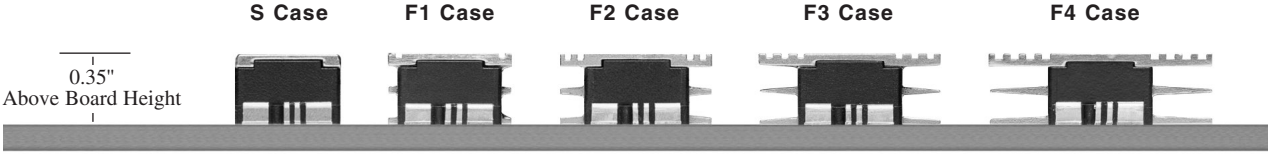
Part Numbering

PS | **48** | **M** | **3V3D** | **C** | **S**

- **48** — *Input Voltage*
- **M** — *Mounting Height* ***M**: 0.35"*
- **3V3D** — *Output Voltage*
  - 1V5 = 1.5V, 15A
  - 1V5D = 1.5V, 10A
  - 1V8 = 1.8V, 15A
  - 1V8D = 1.8V, 10A
  - 2 = 2.0V, 15A
  - 2D = 2.0V, 10A
  - 2V5 = 2.5V, 15A
  - 2V5D = 2.5V, 10A
  - 3V3 = 3.3V, 15A
  - 3V3D = 3.3V, 10A
  - 5 = 5V, 12A
  - 12 = 12V, 75W
- **C** — *Product Grade Temperatures (°C)*

Grade		Storage	Operating
C	=	– 40 to +125	– 20 to +100
T	=	– 40 to +125	– 40 to +100

- **S** — *Case Configuration* ***See below and page 7***



ELECTRICAL CHARACTERISTICS

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

■ MODULE OPERATING SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Operating input voltage	36	48	75	Vdc	
Input surge withstand			100	Vdc	<100ms

■ MODULE OUTPUT VOLTAGE RELATED SPECIFICATIONS

Parameter	1.5 to 3.3V	5V	12V	Unit	Notes
Output Voltage Setpoint	±1%	±1%	±1%	Vout nom.	Nominal Input, 75% load, 25°C
Ripple and noise, p-p (typ.)	180	250	160	mV	Nominal Input; full load; 25°C, 20MHz BW
Output Power (max.)		60	75	Watts	At 100°C Case Temperature
Output Current (max.)	10 or 15			Amps	At 100°C Case Temperature
Output OVP setpoint (nom.)	115% Vnom +0.5	6.3	14.3	Volts	
Dissipation, standby (typ.)	1.8	1.9	1.9	Watts	No load; nominal input
Load regulation (max.)	0.3	0.3	0.2	±% Vout	No load to full load; nominal input
Current limit (typ.)	115	115	115	% Iout	Output voltage 95% of nominal
Short circuit current (typ.)	115	115	115	% Iout	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.

Note: For important information relative to applications where the converters are subject to continuous dynamic loading, contact Vicor Applications Engineering at 800-927-9474 or your local Vicor office.

ELECTRICAL CHARACTERISTICS, continued

■ MODULE CONTROL SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
PRIMARY SIDE (PC = Primary Control; PR = Parallel)					
PC bias voltage current limit	1.5	2.1	3.0	mA	PC voltage = 5.5V
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, 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)	1500			Vdc	
Isolation voltage (in to case)	1500			Vdc	
Isolation voltage (out to case)	1500			Vdc	
Isolation resistance (in to out)		10		Megohms	
Weight		0.9 (26)		Ounces (grams)	S Case
Agency Approvals		UL, CSA, TÜV, BABT, CE, VDE			UL1950, CSA950, EN60950, VDE0805, BS7002, IEC 60950. With a fuse in a series with the +Input

■ TYPICAL PERFORMANCE 45°C, 400LFM, 100% Duty Cycle

Case Configuration	S	F1	F2	F3	F4
Max. Power @ 12Vout	32W	37W	45W	55W	71W
Max. Current @ 3.3Vout	6.4A	7.5A	9A	11A	14A

For complete thermal design support, and the complete list of package options, see our web site at vicr.com/powerstick.

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, 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 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.

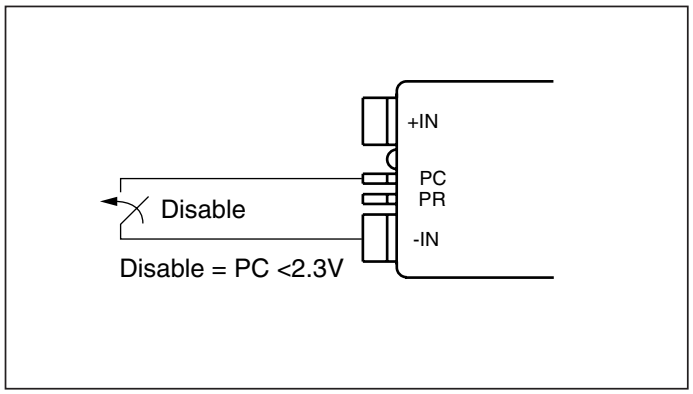


***Figure 1**—Module enable/disable.*

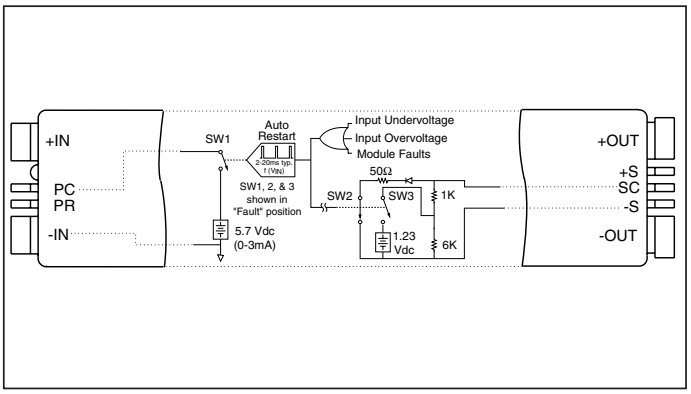


***Figure 2**—PC/SC module alarm logic.*

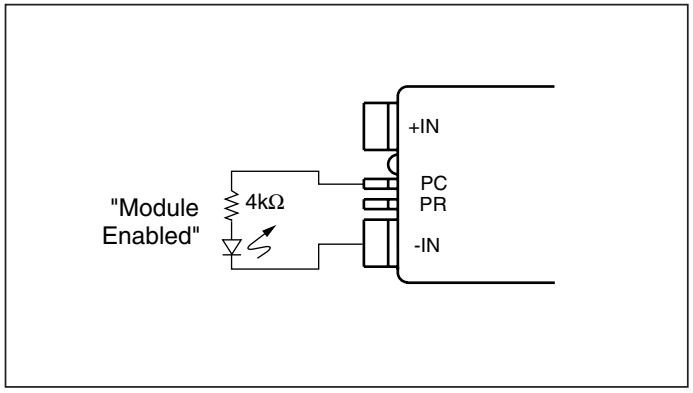


***Figure 3**—LED on-state indicator.*

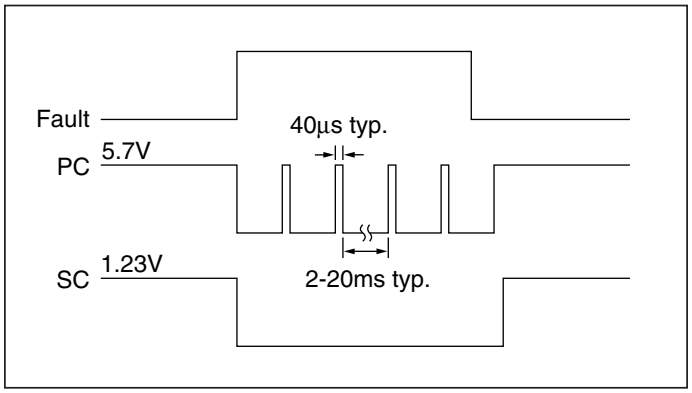


***Figure 4**—PC/SC module alarm timing.*

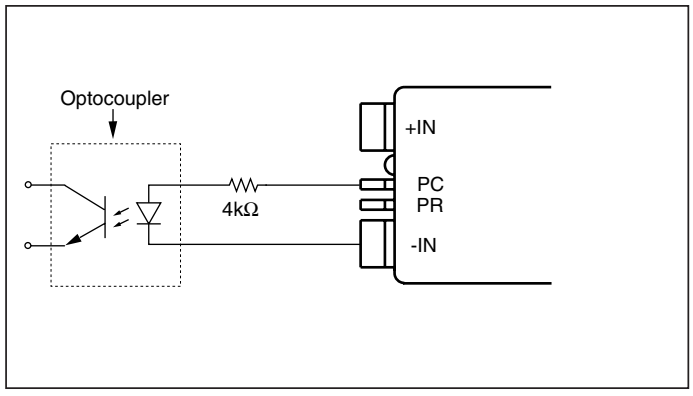


***Figure 5**—Isolated on-state indicator.*

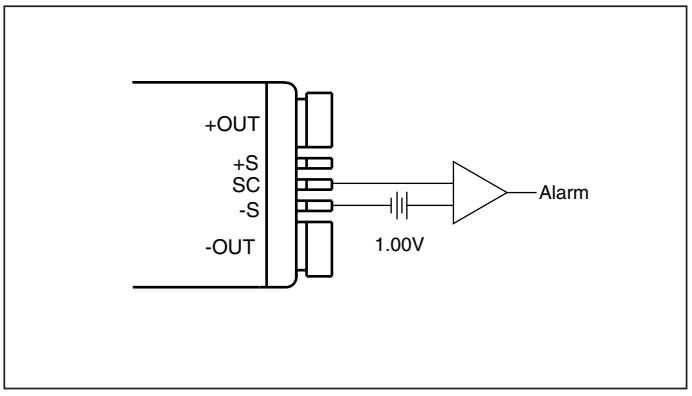


***Figure 6**—Secondary side on-state indicator.*

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.

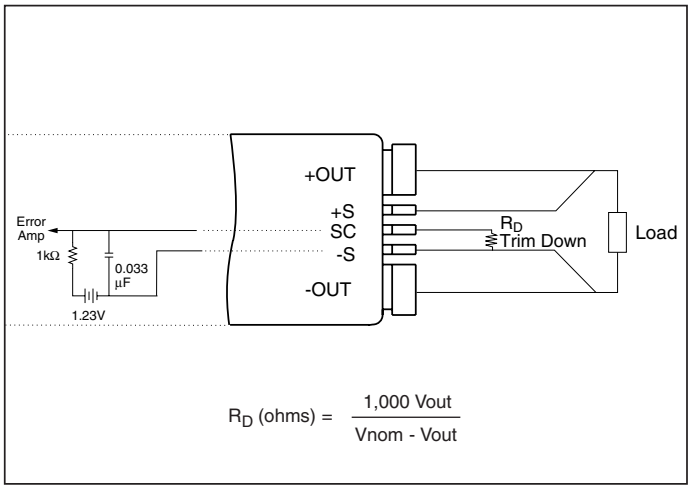


***Figure 7**—Output voltage trim down circuit.*

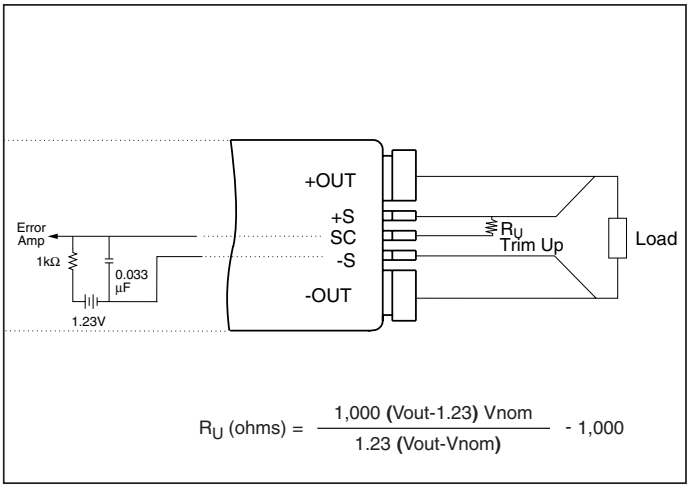


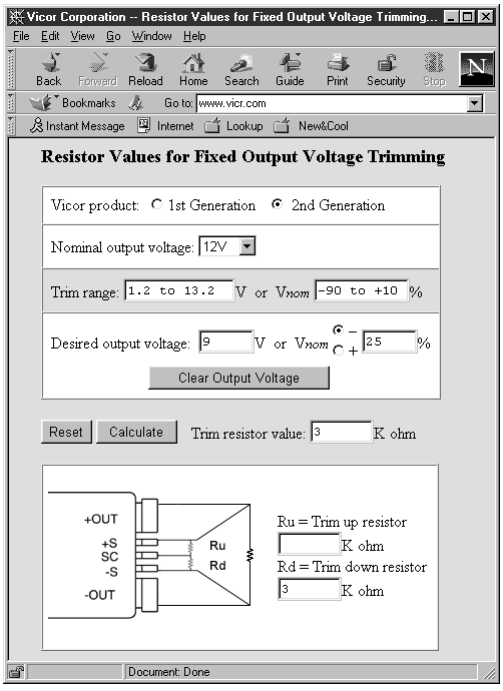
***Figure 8**—Output voltage trim up circuit.*

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. As output voltage is increased, reduce output current maximum to insure that maximum rated power is not exceeded.
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, vicr.com, by selecting Calculators from the Toolbox.

Resistor values can be calculated for fixed trim up, fixed trim down and for variable trim up or down by selecting the trim calculator for 2nd Generation DC-DC converters.

In addition to trimming information, the web site also includes 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 (see Phased Array Control Chip at vicr.com). 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.

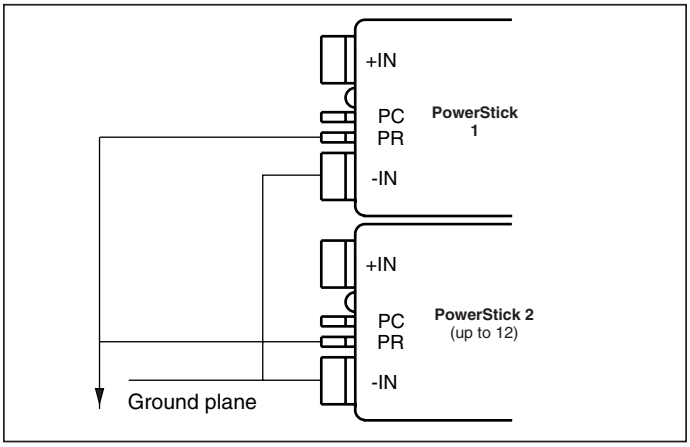


***Figure 9**—DC coupled single-wire interface.*

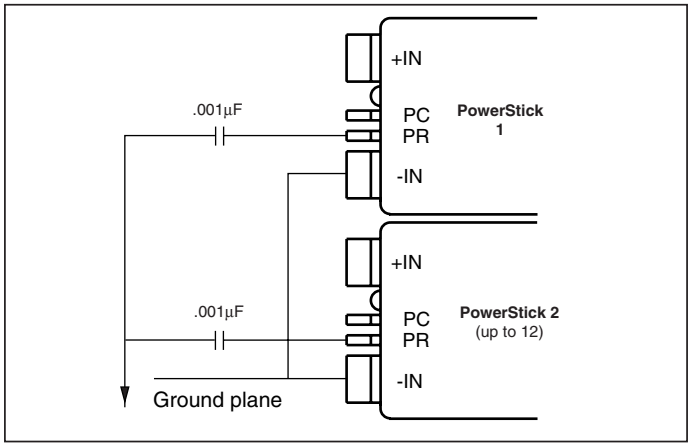


***Figure 10**—AC coupled single-wire interface.*

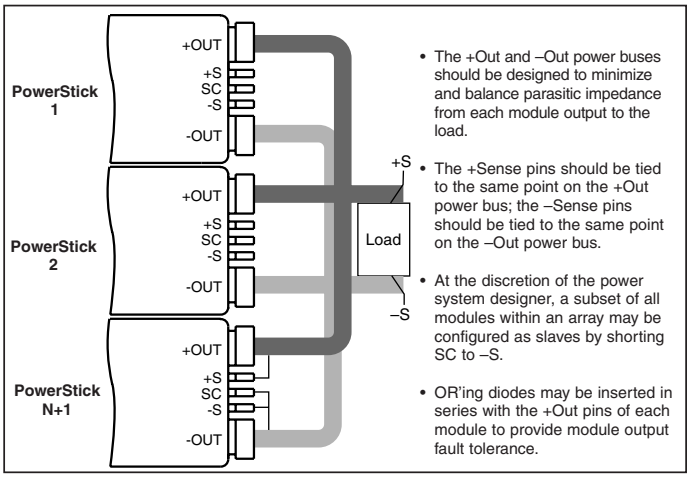


***Figure 11**—N+1 module array output connections.*

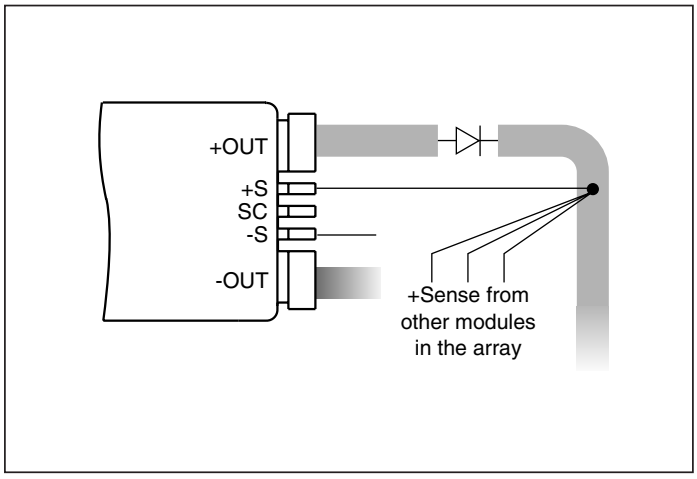
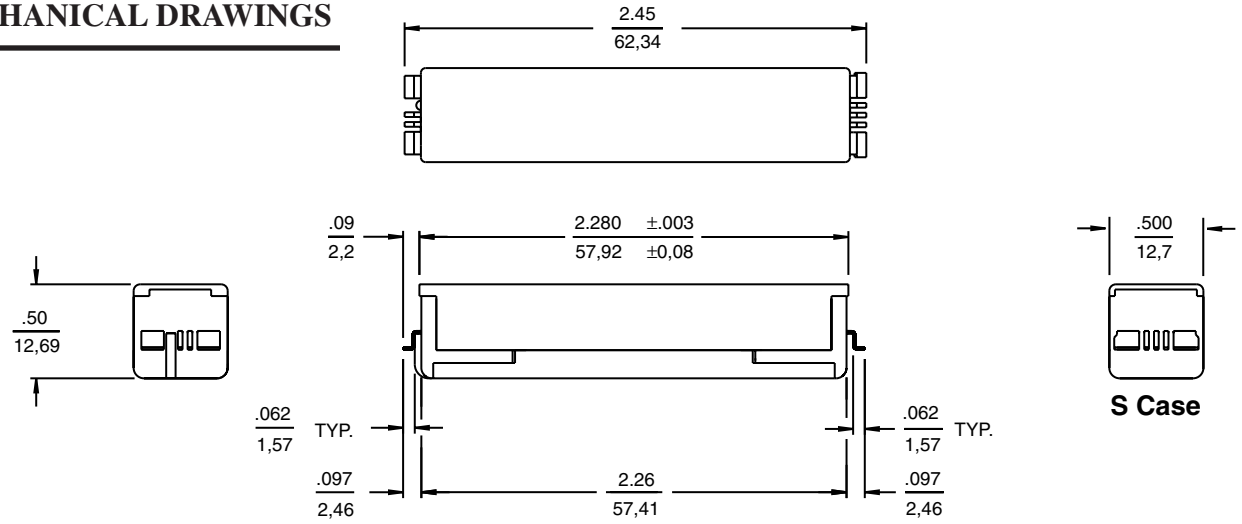


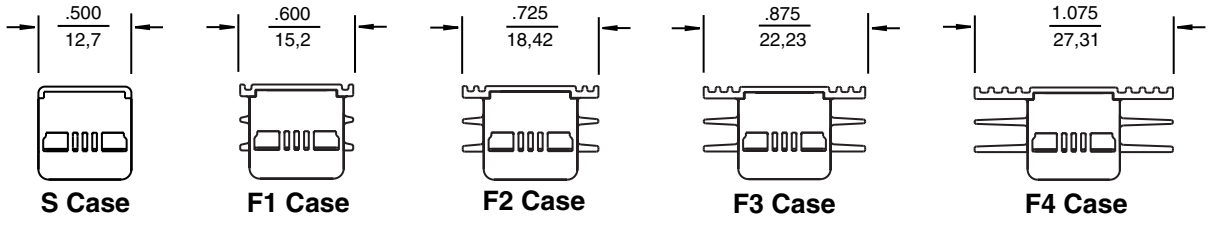
***Figure 12**—OR'ing diodes connections.*

MECHANICAL DRAWINGS

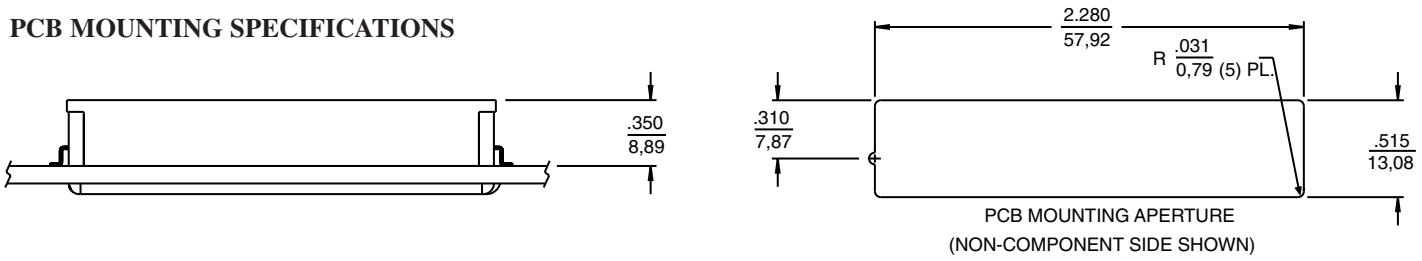


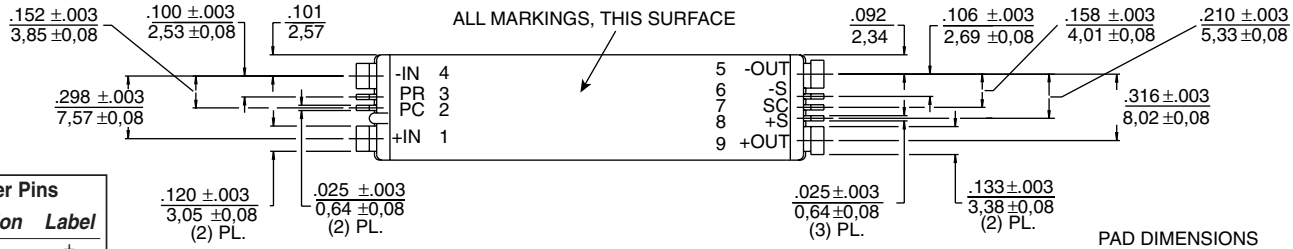
Typical Case Configurations

For comprehensive thermal management information, visit vicr.com/powerstick

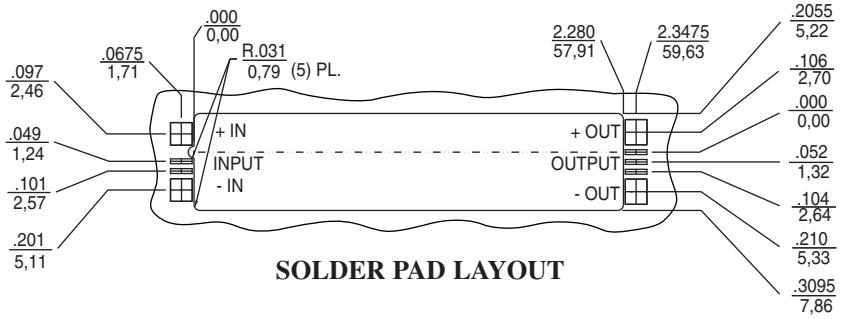


PCB MOUNTING SPECIFICATIONS



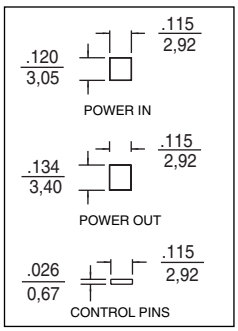


Converter Pins		
No.	*Function*	*Label*
1	+In	+
2	Primary Control	PC
3	Parallel	PR
4	–In	–
5	–Out	–
6	–Sense	–S
7	Secondary Control	SC
8	+Sense	+S
9	+Out	+



SOLDER PAD LAYOUT

PAD DIMENSIONS



Shock and Vibration rating for standard mounting: 5grms vibration, 500g shock

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

Specifications are subject to change without notice.
The latest data is available on the Vicor web site at vicr.com.

Component Solutions
for Your Power System

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