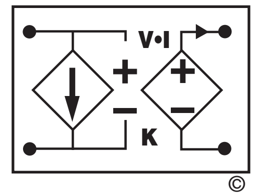
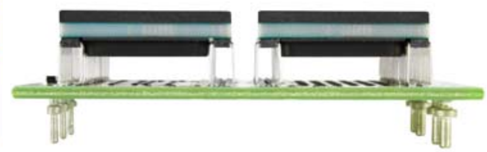
V•I Chip™ VIC-in-a-Brick

Intermediate Bus Converters Quarter-Brick, 48 Vin Family

3 to 48 Vdc Bus Voltages; 100 A - 600 W Output





Features

- Up to 600 W
- 95% efficiency @ 3 Vdc
- 600 W @ 55ºC, 400 LFM
- 125°C operating temperature
- 400 W/in^3 power density
- 38-55 Vdc input range
- 100 V input surge for 100 ms
- SAC topology
- Low noise ZCS/ZVS architecture
- 3.5 MHz switching frequency
- Fast dynamic response
- Parallelable, with fault tolerance
- 2,250 Vdc basic insulation

Product Overview

These "VIC-in-a-Brick" Intermediate Bus Converter (IBC) modules use Vicor's V•I Chip Bus Converter Modules (BCM) to achieve the highest performance for Intermediate Bus Architecture applications. Operating from a 38-55 Vdc input, ten different fixed ratio outputs are available from 3 to 48 Vdc. You can choose the intermediate bus voltage that is optimal for your system and load requirements.

These quarter-bricks are available with a single BCM, rated up to 300 W or 70 A, or with dual BCMs, capable of 600 W or 100 A. Dual output pins are used for output currents over 50 A.

Utilizing breakthrough Sine Amplitude Converter (SAC) technology, BCMs offer the highest efficiency, lowest noise, fastest transient response and highest power density. And full load power is available at 55ºC with only 200 LFM of air for single BCM versions and 400 LFM for dual BCM versions, without a heatsink.

Absolute Maximum Ratings

Parameter	Rating	Unit	Notes
+In to –In voltage			
Continuous	-1.0 to +60.0	Vdc	
Surge	100	Vdc	<100ms
PC to –In voltage	-0.3 to +7.0	Vdc	
Isolation voltage			Basic Insulation
Input to output	2,250	Vdc	
In/Out to heat sink	1,500	Vdc	
Operating temperature	-40 to +125	°C	Junction
Pin soldering temperature			
Wave	500 (260)	°F (°C)	<5 sec
Hand	750 (390)	°F (°C)	<7 sec

Thermal Resistance and Capacity

Parameter	Typ	Unit
VIC to ambient; 0 LFM (Single BCM)	13.3	°C/W
VIC to ambient; 0 LFM (Dual BCM)	11.7	°C/W
VIC to ambient; 200 LFM (Single BCM)	6.1	°C/W
VIC to ambient; 200 LFM (Dual BCM)	4.3	°C/W
Thermal capacity (Single BCM)	14.3	Ws/°C
Thermal capacity (Dual BCM)	22.8	Ws/°C

PART NUMBERING

I	048	C	030	T	015	P	2
Format I = IBC	Nominal Input Voltage	C = 1/4 Brick	Nominal Output Voltage (x10)	Product Grade T= -40 to 125°C	Output Power (x 0.1	Enable Polarity P="+" M="–" (see note 3)	Package Style (See pg 7)

PRODUCT MATRIX

Output Voltage (see note 1)	Full Load Output (Note 2)		Bus Converter Model No. (see note 3)	Number of BCMs	K Factor (Transformation Ratio)	Full Load Efficiency (%)	ROUT (mΩ)	Max Load Capacitance (see note 4)
	Watts	Amps						
3.0	150	50 *	I048C030T015P1	1	1/16	95.5	2.0	31,000 µF
	210	70	I048C030T021P2	1		94.7	2.0	31,000 µF
	300	100 **	I048C030T030P2	2		94.6	1.0	62,000 µF
4.0	200	50 *	I048C040T020P1	1	1/12	96.0	2.3	17,000 µF
	240	60	I048C040T024P2	1		95.4	1.2	17,000 µF
	400	100 **	I048C040T040P2	2		96.0	1.2	34,000 µF
6.0	270	45	I048C060T027P1	1	1/8	96.2	4.0	7,600 µF
	540	90	I048C060T054P2	2			2.0	15,200 µF
8.0	300	37	I048C080T030P1	1	1/6	96.3	7.2	4,300 µF
	400	50 ***	I048C080T040P1	2		96.9	3.6	8,600 µF
	600	75	I048C080T060P2	2		96.3	3.6	8,600 µF
9.6	240	25	I048C096T024P1	1	1/5	96.3	10.0	3,000 µF
	480	50	I048C096T048P1	2			5.1	6,000 µF
12	200	17	I048C120T020P1****	1	1/4	95.7	20.5	1,000 µF
	300	25	I048C120T030P1	1		96.7	13.0	1,000 µF
	400	34	I048C120T040P1****	2		95.7	10.3	2,000 µF
	600	50	I048C120T060P1	2		96.7	6.5	2,000 µF
16	300	18.8	I048C160T030P1	1	1/3	96.8	20.0	900 µF
	600	37.5	I048C160T060P1	2			10.0	1,800 µF
24	300	12.5	I048C240T030P1	1	1/2	97.2	42.0	470 µF
	600	25	I048C240T060P1	2			21.0	940 µF
32	300	9.4	I048C320T030P1	1	2/3	97.0	67.0	200 µF
	600	18.7	I048C320T060P1	2				400 µF
48	300	6.3	I048C480T030P1	1	1	97.0	150.0	100 µF
	600	12.5	I048C480T060P1	2			75.0	200 µF

* Full load capability is actually 70 A at 3 V and 60 A at 4 V. The maximum rating of the output pins is 50 A.
** Full load capability is actually 140 A at 3 V and 120 A at 4 V. The maximum rating of the output pins is 100 A.
*** Full load capability is actually 75 A. The maximum rating of the output pins is 50 A.
**** Input voltage range is 42 V min to 53 V max.

Notes:
1: Output voltage at 48 Vdc input, no load and 25°C temperature.
2: Maximum power and current ratings should not be exceeded under normal operating conditions.
3: The ending "P" indicates positive enable logic (pull PC pin low to disable). Change to "M" to indicate negative logic (pull PC pin low to enable).
4: Exceeding this value can cause the unit not to turn on into load.

ELECTRICAL CHARACTERISTICS

For comprehensive data on any of the configurations, please refer to the data sheet for the BCM with output voltage (K Factor) of the Intermediate Bus Converter of interest. Data sheets are available from our website at www.vicorpower.com.

Electrical characteristics apply over the full operating range of input voltage, output load (resistive) and case temperature, unless otherwise specified.

INPUT SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Operating input voltage	38	48	55	Vdc	12 V 200 W & 400 W units are 42–53 Vdc
Input surge withstand			100	Vdc	<100ms
Undervoltage					
Turn-on		36.1	38	Vdc	
Turn-off	32.6	33.8		Vdc	
Overvoltage					
Turn-off	55.0			Vdc	
Turn-on			59	Vdc	
Input reflected ripple current		3		% Iin	mA p-p with recommended external input capacitor
Input dV/dt			10	V/µs	
Turn-on time					
Power up		300		ms	
PC enable		50		µs	
No load power dissipation		2.5		W	per BCM
Recommended external input capacitance	10	50		µF	200 nH maximum source inductance

OUTPUT SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Output voltage accuracy		±2		%	48 V input; no load; 25°C
Peak repetitive output current			150	%	<1 ms; see note 2 below
Current limit		125		%	See note 1 below
Average short circuit current		200		mA	
Efficiency		96.0		%	48 Vin; full load; 25°C
Output OVP setpoint		120		%	
Line regulation					Fixed ratio; Vout = Vin•K (see product matrix)
Load regulation					ΔVout = ΔIout•Rout (see product matrix)
Temperature regulation		±0.05		% / °C	
Ripple and noise, p-p		100		mV	48 Vin; full load; 20 MHz bandwidth
Switching frequency		3.5		MHz	Fixed
Power sharing accuracy		±5	±10	%	10 to 100% load
Transient response					No load - full load step change, see note 2 below
Voltage deviation		2		%	
Response time		200		ns	
Recovery time		1		µs	

Note 1: Current limit parameter does not apply for all models. Please see product matrix on page 2 for exceptions.
Note 2: For important information relative to applications where the unit is subjected to continuous dynamic loading, contact Vicor applications engineering at 800-927-9474.

SAFETY SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Isolation voltage					Complies with basic insulation requirements
Input to output	2,250			Vdc	
In/Out to chassis	1,500			Vdc	
Isolation resistance	10			MΩ	Input to output
Agency approvals (pending)		cTÜVus			UL/CSA 60950, EN 60950
		CE Mark			Low voltage directive

THERMAL SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Operating junction temperature	-40		+125	°C	
Storage temperature	-40		+150	°C	
Temperature limiting	125	130	135	°C	Junction temperature
Thermal capacity					
1 BCM		14.3		Ws/°C	
2 BCM		22.8		Ws/°C	
Pin soldering temperature					
Wave			500 (260)	°F (°C)	<5 sec
Hand			750 (390)	°F (°C)	<7 sec

GENERAL SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
MTBF					
MIL-HDBK-217F		3,600		Khrs	25°C, GB; per BCM
Telcordia TR-NT-000332		4,200		Khrs	per BCM
Weight		3.7 (104)		oz (g)	
Dimensions		2.3 x 1.45 x 0.47		in	L x W x H
		58,4 x 36,8 x 11,9		mm	L x W x H

CONTROL SPECIFICATIONS – PRIMARY CONTROL (PC PIN)

Parameter	Min	Typ	Max	Unit	Notes
Voltage (P version)	4.8	5.0	5.2	Vdc	
Disable voltage (P version)	2.4	2.5		Vdc	
Enable voltage (P version)		2.5	2.6	Vdc	
Enable voltage (M version)	1.2	1.5		Vdc	
Disable voltage (M version)		1.5	3.5	Vdc	
Current limit (P version)	2.4	2.5	2.9	mA	Source only

PIN/CONTROL FUNCTIONS

+IN / –IN — DC Voltage Input Pins
The "VIC-in-a-Brick" Intermediate Bus Converter (IBC) input voltage range should not be exceeded. The V•I Chip BCM's internal under/over voltage lockout-function prevents operation outside of the normal input range. The BCM turns ON within an input voltage window bounded by the "Input under-voltage turn-on" and "Input over-voltage turn-off" levels, as specified. The IBC may be protected against accidental application of a reverse input voltage by the addition of a rectifier in series with the positive input, or a reverse rectifier in shunt with the positive input located on the load side of the input fuse.

Input impedance
Vicor recommends a minimum of 10 µF bypass capacitance be used on-board across the +IN and –IN pins. The type of capacitor used should have a low Q with some inherent ESR such as an electrolytic capacitor. If ceramic capacitance is required for space or MTBF purposes, it should be damped with approximately 0.3 Ω series resistance.

Anomalies in the response of the source will appear at the output of the IBC multiplied by its K factor. The DC resistance of the source should be kept as low as possible to minimize voltage deviations. This is especially important if the IBC is operated near low or high line as the over/under voltage detection circuitry of the BCM(s) could be activated.

PC — Primary Control Pin
The Primary Control pin is a multifunction node that provides the following functions:

Enable/Disable
Standard "P" configuration — If the PC pin is left floating, the BCM output is enabled. Once this port is pulled lower than 2.4 Vdc with respect to –IN, the output is disabled. This action can be realized by employing a relay, opto-coupler or open collector transistor. This port should not be toggled at a rate higher than 1 Hz.

Optional "M" configuration — This is the reverse function as above: when the PC pin is left floating , the BCM output is disabled.

Primary Auxiliary Supply — The PC pin can source up to 2.4 mA at 5.0 Vdc. (P version only)

Alarm — The BCM contains watchdog circuitry that monitors output overload, input over voltage or under voltage, and internal junction temperatures. In response to an abnormal condition in any of the monitored parameters, the PC pin will toggle. (P version only)

+OUT / –OUT — DC Voltage Output Pins
The 0.062" diameter + and – output pins are rated for a maximum current of 50 A. Two sets of pins are provided for all units with a current rating over 50 A. These pins must be connected in parallel with minimal interconnect resistance. Within the specified operating range, the average output voltage is defined by the Level 1 DC behavioral model of the on board BCM(s) as defined in the appropriate BCM data sheet.

Output impedance
The very low output impedance of the IBC, as shown in the Product Matrix table, reduces or eliminates the need for limited life aluminum electrolytic or tantalum capacitors at the input of the non-isolated point-of-load converters.

Load capacitance
Total load capacitance at the output of the IBC should not exceed the specified maximum as shown in the Product Matrix table. Owing to the wide bandwidth and low output impedance of the BCM, low frequency bypass capacitance and significant energy storage may be more densely and efficiently provided by adding capacitance at the input of the IBC.

Bi-directional operation
The BCM power train and control architecture allow bi-directional power transfer, including reverse power processing from the BCM output to its input. Reverse power transfer is enabled if the BCM input is within its operating range and the BCM is otherwise enabled. The BCM's ability to process power in reverse significantly improves the IBC transient response to an output load dump.

THERMAL MANAGEMENT

Figures 2 to 5 provide the IBC's maximum ambient operating temperature vs. BCM power dissipation for a variety of airflows. In order to determine the maximum ambient environment for a given application, the following procedure should be used:

1. Determine the maximum load powered by the IBC.
2. Determine the power dissipated at this load by the on-board BCM(s).
   a) If using a 1 BCM configuration, this dissipation is found in Fig. 6 on the appropriate BCM data sheet corresponding to the output voltage of the IBC.
   b) If using a 2 BCM configuration, divide the maximum load by 2. The power dissipated by each BCM is found in Fig. 6 on the appropriate BCM data sheet corresponding to the output voltage of the IBC. This number should then be multiplied by 2 to reflect the total dissipation.
3. Determine the airflow orientation from Fig.1.
4. Using the chart corresponding to the appropriate airflow angle, find the curve corresponding to the airflow velocity and read the maximum ambient operating temperature of the IBC (y-axis) based on the total BCM power dissipation (x-axis).

For additional information on V•I Chip thermal design, please read the "Thermal Management" section of the BCM data sheet.

■ THERMAL MANAGEMENT (Cont.)

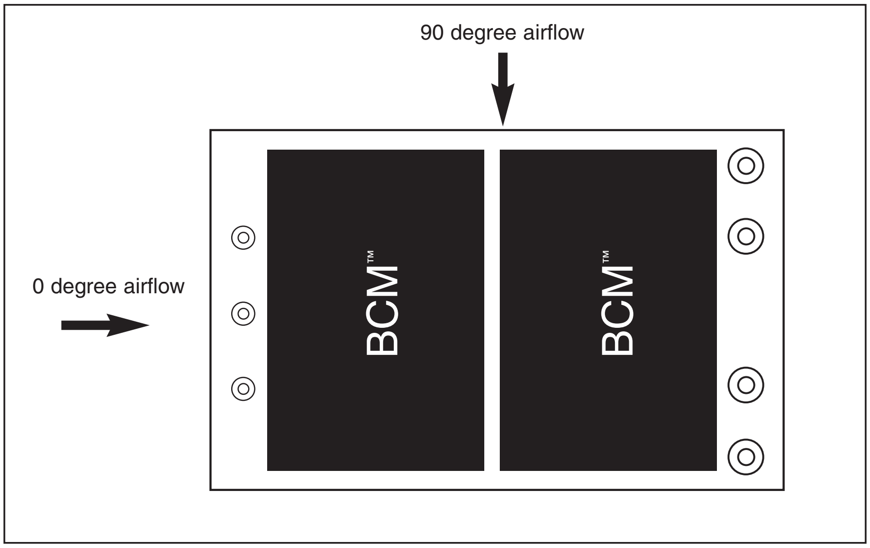


Figure 1— *0 and 90 degree airflow orientations for 1 or 2 BCM configurations*

Note: Other configurations and orientations are available, including versions with integral heatsinks. Please consult the factory for additional information.

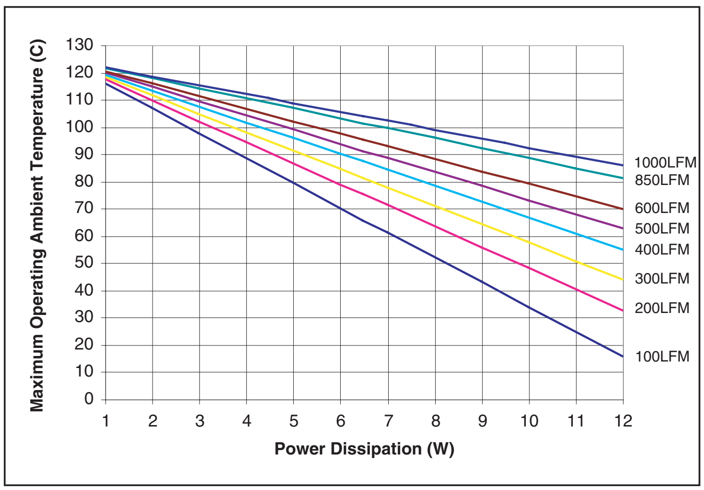


Figure 2— *Maximum operating ambient temp. curves for 1 BCM with 0 degree airflow*

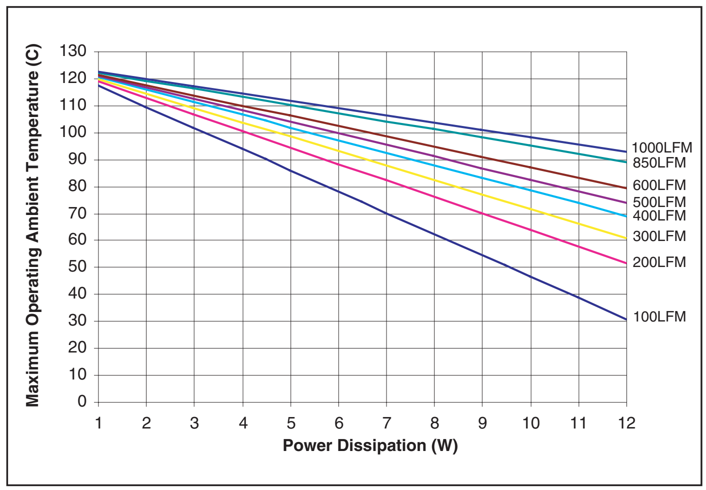


Figure 3— *Maximum operating ambient temp. curves for 1 BCM with 90 degree airflow*

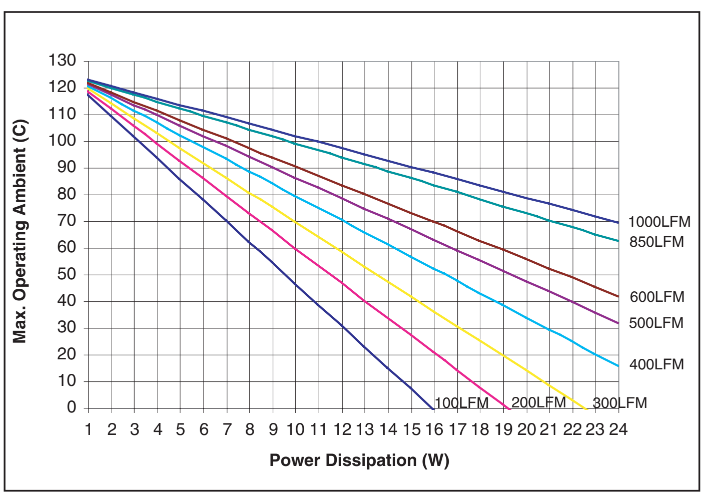


Figure 4— *Maximum operating ambient temp. curves for 2 BCM with 0 degree airflow*

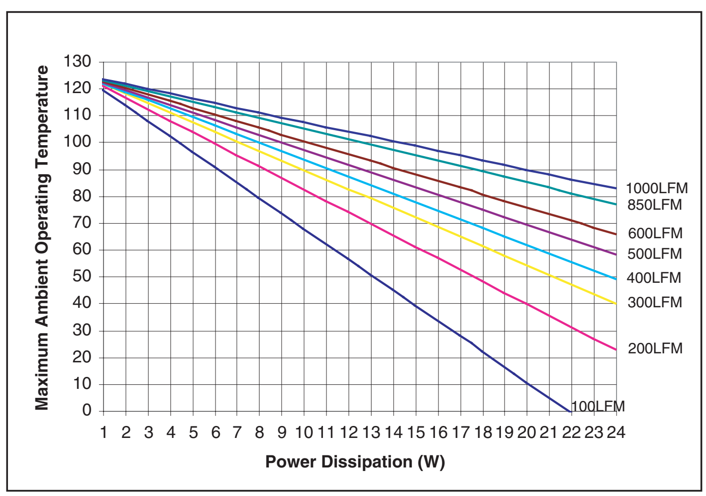
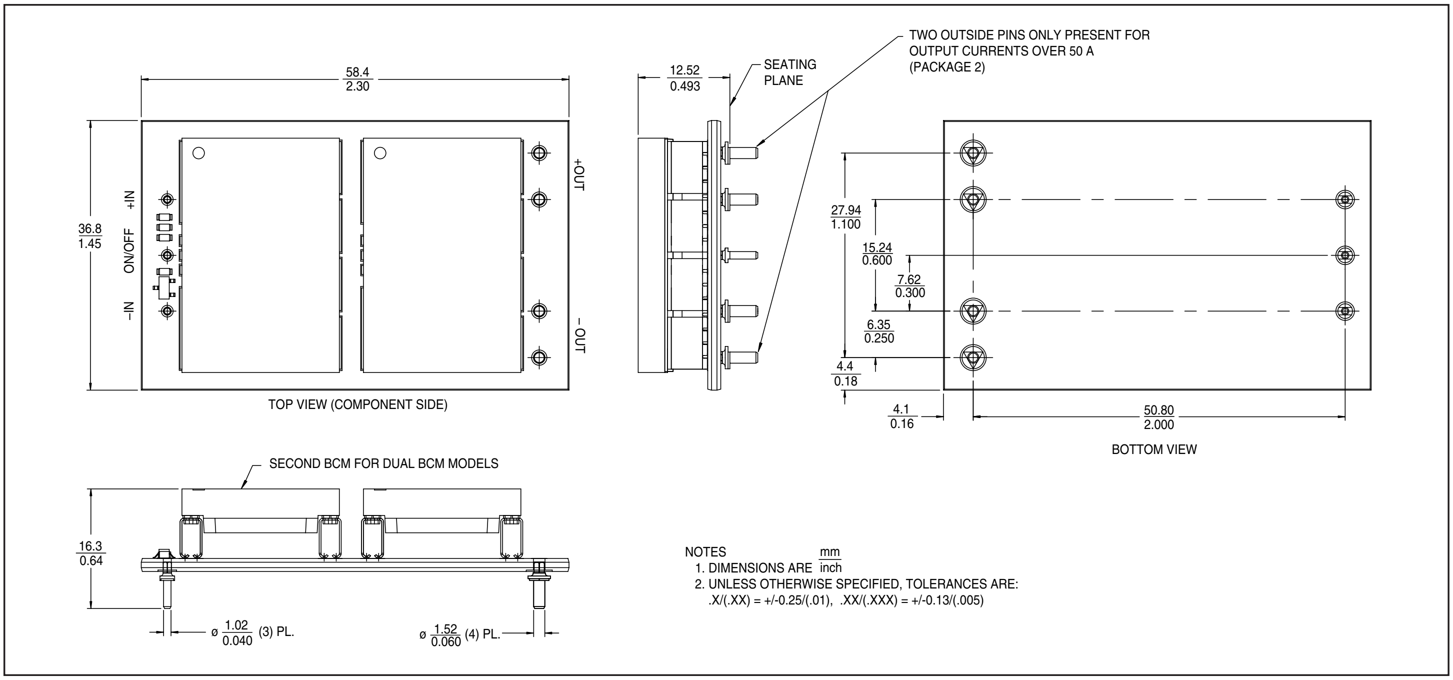


Figure 5— *Maximum operating ambient temp. curves for 2 BCM with 90 degree airflow*

■ MECHANICAL DRAWINGS



PACKAGING CONFIGURATIONS

PACKAGE STYLE	DESCRIPTION
1	Single output pins
2	Dual output pins

INPUT FUSING

V•I Chips are not internally fused in order to provide flexibility in power system configuration. However, input line fusing of V•I Chips must always be incorporated within the power system. The input line fuse should be placed in series with +IN.

INPUT FUSE VALUE

Bus Converter Model No.	Little Fuse Nano 451/453 Series	San–O SV 12/14 5/20 Series	Little Fuse 3AB Series
I048C030T015P1	6.3 A		
I048C030T021P2	8 A		
I048C030T030P2	12 A		
I048C040T020P1	8 A		
I048C040T024P2	10 A		
I048C040T040P2	15 A		
I048C060T027P1	12 A		
I048C060T054P2			25 A
I048C080T030P1	12 A		
I048C080T040P1	15 A		
I048C080T060P2			25 A
I048C096T024P1	10 A		
I048C096T048P1		20A	
I048C120T020P1	8 A		
I048C120T030P1	12 A		
I048C120T040P1	15 A		
I048C120T060P1			25 A
I048C160T030P1	12 A		
I048C160T060P1			25 A
I048C240T030P1	12 A		
I048C240T060P1	25 A		
I048C480T030P1	12 A		
I048C480T060P1			25 A

Vicor's comprehensive line of power solutions includes high density AC-DC and DC-DC modules and accessory components, fully configurable AC-DC and DC-DC power supplies, and complete custom power systems.

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Vicor and its subsidiaries own Intellectual Property (issued U.S. and Foreign Patents and pending patent applications) relating to the product described in this data sheet including;

- The electrical and thermal utility of the V•I Chip package
- The design of the V•I Chip package
- The Power Conversion Topology utilized in the V•I Chip package
- The Control Architecture utilized in the V•I Chip package
- The Factorized Power Architecture.

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