

VI-IAM™/MI-IAM™ Input Attenuator Module

Overview

The VI-IAM is a component-level, DC input front end filter that when used in conjunction with Vicor converters provides a highly efficient, high density power system with outputs from 1 to 95Vdc and power expansion from 25 to 800W.

- EMC Filtering
- Transient Protection
- Reverse Polarity Protection
- Inrush Current Limiting
- UL, CSA, TÜV Approval

There are five input attenuator modules available for the commercial market that comply with telecommunication and industrial control EMC specifications: Refer to data sheets for applicable standards.

Model	Input Voltage Range	Max. Output Power* of Converter Combinations
VI-A11-CU	24V (21-32V)	200W
VI-AWW-CU	24V "W" (18-36V)	200W
VI-A33-CQ	48V (42-60V)	400W
VI-ANN-CQ	48V "N" (36-76V)	400W
VI-A66-CQ	300V (200-400V)	400W

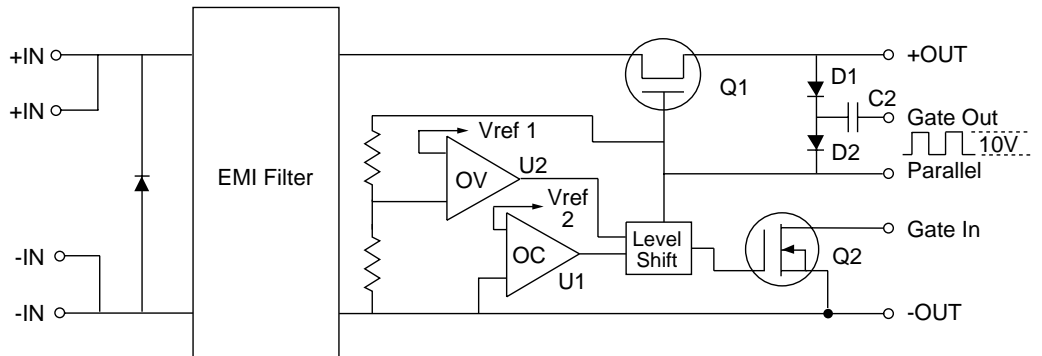
*Based on 5V output and above converters.

There are two input attenuator modules available for the defense market that comply with military EMC specifications, transient specifications and spike specifications. Refer to product datasheet for applicable standards.

Model*	Input Voltage Range	Max. Output Power of Converter Combinations
MI-A22-MU	28V (18-50V)	200W
MI-A66-MU	270V (125-400V)	200W

*I temperature grade is available.

Figure 1.
Block Diagram of
Input Attenuator
Module (VI-IAM)



EMC

EMC performance is guaranteed when the VI-IAM is used in conjunction with Vicor converters within the permissible power rating and in accordance with the recommended installation procedure (Figure 2, page 14-4). The capacitor shown across the input of the converter, bypass capacitors and series resistors shown on the –In and +In of the DC-DC converters to ground are required to meet EMC specifications. The capacitors should be Y-rated (interference suppression). These capacitors have high voltage breakdown ratings to meet the isolation characteristics of the module’s input to baseplate specification plus self-healing properties, and have safety agency approvals.

Input Reverse Polarity Protection

A zener diode in the EMC filter provides reverse polarity protection when used with a current limiting device external to the VI-IAM. The characteristics of the recommended input line fuses permit normal full load operation with protection in the event of a reverse polarity; see table below.

Input Transient Protection

A zener diode, inductor and capacitor in the EMC filter protect against short term transients. Transient voltages that persist beyond these limits are dropped across an N-channel enhancement FET, Q1. It is necessary that the FET be kept in saturation mode during normal operation. Thus it is necessary to connect the DC-DC converters’ Gate Out to the VI-IAM’s Gate Out to charge pump the gate of the FET to a voltage in excess of its source. In the case where multiple DC-DC driver modules are connected to one VI-IAM, an external charge pump through the parallel pin (connected to the gate of the FET) must be added to ensure that the FET remains enhanced in the event Gate Out enhancement is lost (Figure 3, page 14-4). The additional circuitry, C2, D1 and D2 are added externally to charge pump through the parallel pin.

Shutdown of the DC-DC converters is accomplished by saturating Q2 during an input over-voltage to prevent possible damage to the converters. The VI-IAM will automatically restart when the input overvoltage is reduced to within the input voltage range.

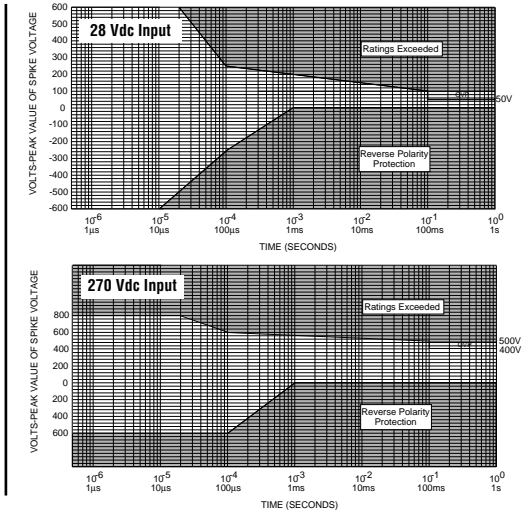
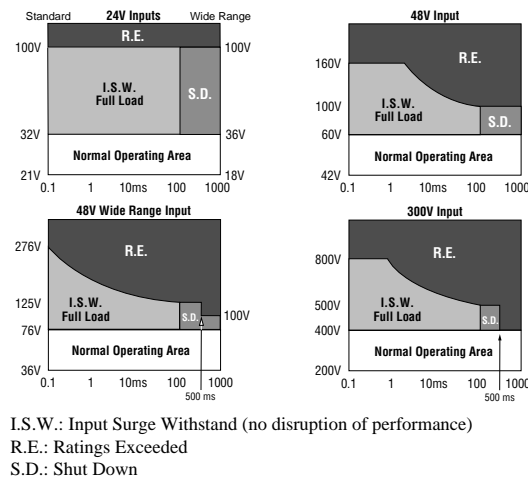
If the long term transient withstand specifications are exceeded, the recommended external fuse will clear.

Input Voltage	Recommended Fuse
24V	20A/32V (AGC-20)
24V “W”	20A/36V (AGC-20)
48V	20A/60V (3AB-20)
48V “N”	20A/80V (3AB-20)
300V	5A/250V Bussman PC-Tron
28V	20A/250V (3AB-20 or F03A, 125V, 20A)
270V	5A/250V Bussman PC-Tron or F03A, 250V, 4A

Input Transient Protection (cont)

Safe Operating Area

(1% duty cycle max., $Z_s = .5\Omega$, for short duration transient capability refer to specifications)



Input Current

Inrush current is a function of the number of DC-DC converters that are connected to the input attenuator module (modules are not gated off at turn-on) and the amount of external capacitance added between the input attenuator module and the DC-DC converter. The inrush current specification is 125% of steady state input current for 10 ms. To avoid excessive dissipation in the element controlling the inrush (Q1), the following maximum values of external capacitance must be adhered to:

Input Voltage	Max. Capacitance*
24Vdc (21-32V)	470 µF
24Vdc (18-36V)	470 µF
28Vdc (18-50V)	390 µF
48Vdc (42-60V)	220 µF
48Vdc (36-76V)	120 µF
270Vdc (125-400V)	27 µF
300Vdc (200-400V)	27 µF

*Capacitance should be distributed across the input of each DC-DC converter (see Figure 2, page 14-4 to reference C1).

Output Overcurrent/Short Circuit Protection

Output overcurrent protection is a foldback type, followed by a timed latched shutdown should the overcurrent persist beyond 2 ms. If the overcurrent condition is removed before the timeout interval, autorestart shall occur. Should latched shutdown occur, input power must be recycled to restart.

Output Overcurrent Threshold	
24Vin “W”, 28Vin, 48Vin “N”	20A ± 5%
24Vin, 48Vin	15A ± 5%
270Vin, 300Vin	4A ± 5%

Expansion Capabilities

The input attenuator module incorporates a parallel pin permitting power expansion as long as the total output power from the DC-DC converters does not exceed the power rating of each input attenuator module (EMC specifications are guaranteed for up to two input attenuators in parallel). It is necessary to include a 100 ohm, 1/4W resistor between the minus outputs of the attenuator modules to ensure equal potential at these points when paralleling input attenuator modules, so as not to impact the effectiveness of the internal common-mode choke.

Figure 2.
External Components
for EMC Requirements

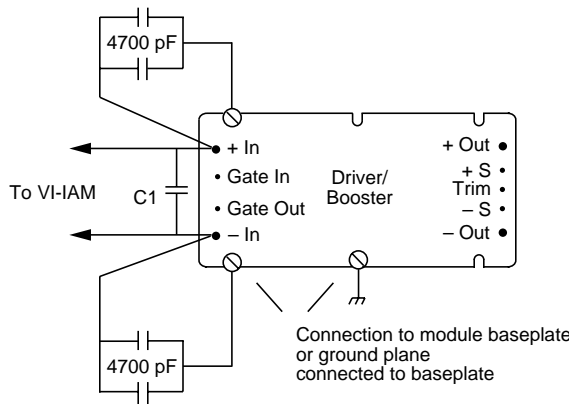
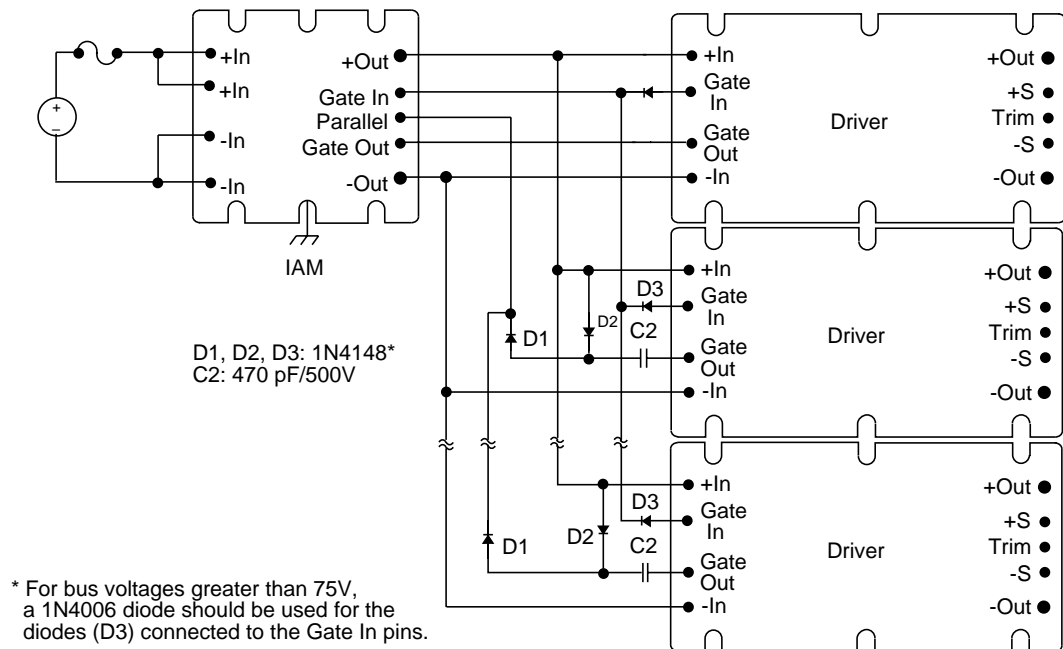
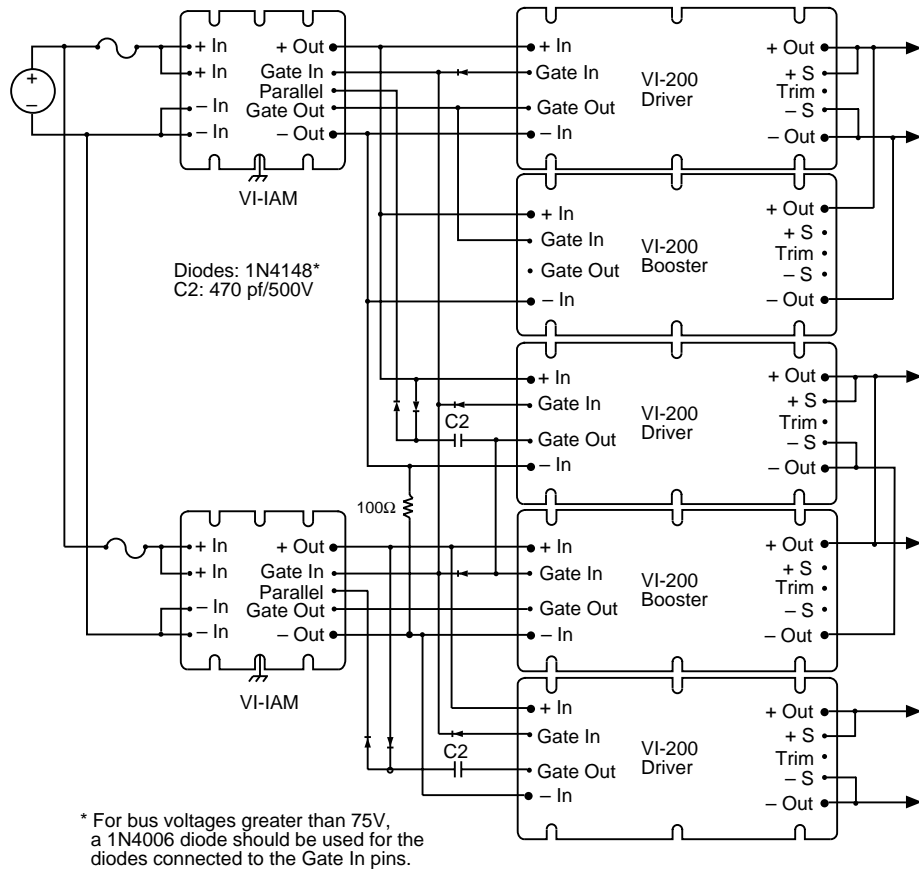


Figure 3.
IAM Multiple Driver
Interconnection



Expansion Capabilities (cont)

Figure 4.
Paralleling
Connections
for the VI-IAM



Safety Considerations

SHOCK HAZARD

Agency compliance requires that the baseplate be grounded or made inaccessible.

FUSING

Safety agency conditions of acceptability require module input fusing. See table on page 14-2 for recommended fuse ratings.

Notes