



## Input Attenuator Module

### Features & Benefits

- Inputs: 28V<sub>DC</sub> and 270V<sub>DC</sub>
- MIL-STD-461C/D/E EMI compliance<sup>[1]</sup>
- MIL-STD-810 environments
- MIL-STD-704, MIL-STD-1275 and DO-160 transients and spikes
- Output power: Up to 200W from any combination of MI-200 or MI-J00 modules
- Expansion port for additional power
- Short circuit protected
- Size: 2.28" x 2.4" x 0.5" (57,9 x 61,0 x 12,7mm)

### Product Highlights

The MI-IAM is an accessory product to Vicor's MI-Series of DC-DC converters that provides EMI filtering and transient protection. Designed for use with all 28V and 270V input MI-200 or MI-J00 converters, the MI-IAM can drive any number of modules with output loads to 200W. See chapter 14 of the Design Guide & Applications Manual for VI-200 and VI-J00 Family DC-DC Converters and configurable Power Supplies for technical description.

The MI-IAM meets the conducted emissions specifications of MIL-STD-461C/D/E<sup>[1]</sup> and offers complete input transient, surge and spike protection to the most severe levels of MIL-STD-1275, MIL-STD-704 and DO-160. Overvoltage lockout provides additional safeguards against potentially damaging line conditions. Higher power arrays can be configured using the expansion port capability of the MI-IAM.

### Compatible Products

- MI-200, MI-J00 (Inputs: 2 and 6)
- MI-Mega Modules (Inputs: 2 and 6)

### Packaging Options

- Standard:** Slotted baseplate
- SlimMod:** Flangeless baseplate, option suffix: - S  
*Example:* MI - AXX - XX - S
- FinMod:** Finned heat sink, option suffix:  
**- F1, - F2, -F3 or -F4**  
*Examples:*  
MI - AXX - XX -F1, 0.25" fins, longitudinal  
MI - AXX - XX -F2, 0.50" fins, longitudinal  
MI - AXX - XX -F3, 0.25" fins, transverse  
MI - AXX - XX -F4, 0.50" fins, transverse

### Input Characteristics (Typical at T<sub>BP</sub> = 25°C, nominal line and 75% load, unless otherwise specified)

Parameter	Min	Typ	Max	Units	Notes
28V <sub>DC</sub> modules					
Steady state input	16	28	50	V <sub>DC</sub>	
Input spike limit	-600		600	V <sub>DC</sub>	20µs, 50Ω per MIL-STD-704A <sup>[a]</sup>
	-250		250	V <sub>DC</sub>	70µs, 15mJ per MIL-STD-1275A/B/D
Input surge limit			100	V <sub>DC</sub>	50ms, 0.5Ω per MIL-STD-1275A/B/D
			80	V <sub>DC</sub>	100ms per DO-160E, Sec.16, Cat. Z
Overvoltage shut down <sup>[b]</sup>	50			V <sub>DC</sub>	100ms, automatic recovery
Recommended fuse			20	Amps	F03A type
270V <sub>DC</sub> modules					
Steady state input	100	270	400	V <sub>DC</sub>	
Input spike limit			800	V <sub>DC</sub>	20µs, 50Ω <sup>[a]</sup>
	-600		600	V <sub>DC</sub>	100µs, 50mJ <sup>[a]</sup>
Input surge limit			500	V <sub>DC</sub>	100ms, 0.5Ω
Overvoltage shut down <sup>[a]</sup>	400			V <sub>DC</sub>	100ms, automatic recovery
Recommended fuse			4	Amps	F03A type
All models					
No load power dissipation		0.5	1.5	Watts	
Inrush current		110	125	% I <sub>N</sub>	Steady state, I <sub>N</sub> 10ms

<sup>[a]</sup> Guaranteed by design – no test data available.

<sup>[b]</sup> The MI-IAM disables downstream converters and clamps the converter input voltage at a safe level.

### Output Characteristics

Parameter	Min	Typ	Max	Units	Test Conditions
Clamp voltage					
28V <sub>DC</sub> input			60	V <sub>DC</sub>	
270V <sub>DC</sub> input			420	V <sub>DC</sub>	
Output power			250	Watts	
Internal voltage drop					
28V <sub>DC</sub>		0.6		V <sub>DC</sub>	
270V <sub>DC</sub>		0.85		V <sub>DC</sub>	
Overload protection					
28V <sub>DC</sub> input			20	Amps	Foldback threshold; auto recovery
270V <sub>DC</sub> input			4	Amps	with latched shut down after 1ms

## Isolation Characteristics

Parameter	Min	Typ	Max	Units	Notes
Input to base		1,500		$V_{RMS}$	1 minute
Output to base		1,500		$V_{RMS}$	1 minute

## EMI Characteristics MIL-STD-461<sup>(1)</sup>

Parameter	Notes
Input power leads	
Conducted emissions	CE01, CE03, CE07 CE101, CE102 MIL-STD-461C MIL-STD-461D/E
Conducted susceptibility	CS01, CS02, CS06, CS101, CS114, CS115, CS116 MIL-STD-461C MIL-STD-461D/E

<sup>(1)</sup> EMI performance is subject to a wide variety of external influences such as PCB construction, circuit layout etc. As such, external components in addition to those listed herein may be required in specific instances to gain full compliance to the standards specified.

## Model Selection Chart

Model Number	Nominal Input Voltage	Input Range	Compatible MI-Series	Converter
MI-A22-MU	28V <sub>DC</sub>	16 – 50V <sub>DC</sub>	MI-22x-Mx and MI-J2x-Mx	M-grade
MI-A66-MU	270V <sub>DC</sub>	125 – 400V <sub>DC</sub>	MI-26x-Mx and MI-J6x-Mx	M-grade
MI-A22-IU	28V <sub>DC</sub>	16 – 50V <sub>DC</sub>	MI-22x-Ix and MI-J2x-Ix	I-grade
MI-A66-IU	270V <sub>DC</sub>	125 – 400V <sub>DC</sub>	MI-26x-Ix and MI-J6x-Ix	I-grade

## Specifications

(Typical at  $T_{BP} = 25^{\circ}\text{C}$ , nominal line and 75% load, unless otherwise specified)

### ENVIRONMENTAL – MIL-STD-810D

Parameter	Min	Typ	Max	Units	Test Conditions
Altitude - method 500.2	70,000			feet	Procedure II
Humidity - method 507.2	88/240			%/hours	Procedure I, cycle 1
Acceleration - method 513.3	9			g	Procedure II
Vibration - method 514.3	20			g	Procedure I, category 6
Shock - method 516.3	40			g	Procedure I

### RELIABILITY – MIL-HDBK-217F (MI-A22-MU)

Parameter	Min	Typ	Max	Units	Test Conditions
25°C Ground Benign: G.B.		5,637		1,000 hours	
50°C Naval Sheltered: N.S.		1,014		1,000 hours	
65°C Airborne Inhabited Cargo: A.I.C.		795		1,000 hours	

### THERMAL CHARACTERISTICS

Parameter	Min	Typ	Max	Units	Test Conditions
Efficiency		97		%	
Baseplate to sink		0.14		$^{\circ}\text{C}/\text{Watt}$	
Operating temperature, baseplate			100	$^{\circ}\text{C}$	See product grade specifications
Storage temperature			125	$^{\circ}\text{C}$	See product grade specifications

### MECHANICAL SPECIFICATIONS

Parameter	Min	Typ	Max	Units	Test Conditions
Weight		3.0 (85)		ounces (grams)	

### PRODUCT GRADE SPECIFICATIONS

Parameter	I-Grade	M-Grade
Storage temperature	-55°C to +125°C	-65°C to +125°C
Operating temperature (baseplate)	-40°C to +100°C	-55°C to +100°C
Power cycling burn-in	12 hours, 29 cycles	96 hours, 213 cycles
Temperature cycled with power off 17°C per minute rate of change	12 cycles -65°C to +100°C	12 cycles -65°C to +100°C
Test data supplied at these temperatures <sup>[a]</sup>	-40°C, +80°C	-55°C, +80°C
Warranty	2 years	2 years
Environmental compliance	MIL-STD-810	MIL-STD-810
Derating	NAVMAT P-4855-1A	NAVMAT P-4855-1A

<sup>[a]</sup> Test data available for review or download from vicorpower.com

## Specifications (Cont.)

### ENVIRONMENTAL QUALIFICATIONS

Parameter	Qualification
Altitude	MIL-STD-810D, Method 500.2, Procedure III, explosive decompression (40K ft.).
	MIL-STD-810D, Method 500.2, Procedure II, 40,000ft., 1000 – 1500ft./min. to 70,000ft., unit functioning
Explosive Atmosphere	MIL-STD-810C, Method 511.1, Procedure I
Vibration	MIL-STD-810D, Method 514.3, Procedure I, category 6, helicopter, 20g
	MIL-STD-810D, Method 514.3 random: 10 – 300Hz @ 0.02g <sup>2</sup> /Hz, 2000Hz @ 0.002g <sup>2</sup> /Hz, 3.9 total Grms 3hrs/axis. Sine: 30Hz @ 20g, 60Hz @ 10g, 90Hz @ 6.6g, 120Hz @ 5.0g, 16.0 total Grms, 3 axes
	MIL-STD-810E, Method 514.4, Table 514.4-VII, ±6db/octave, 7.7Grms, 1hr/axis
Shock	MIL-STD-810D, Method 516.3, Procedure I, functional shock, 40g
	MIL-STD-202F, Method 213B, 18 pulses, 60g, 9msec
	MIL-STD-202F, Method 213B, 75g, 11ms saw tooth shock
	MIL-STD-202F, Method 207A, 3 impacts / axis, 1, 3, 5 feet
Acceleration	MIL-STD-810D, Method 513.3, Procedure II Operational test, 9g for 1 minute along 3 mutually perpendicular axes
Humidity	MIL-STD-810D, Method 507.2, Procedure I, cycle I, 240 hrs, 88% relative humidity
Solder Test	MIL-STD-202, Method 208, 8hr. aging
Fungus	MIL-STD-810C, Method 508.1
Salt-Fog	MIL-STD-810C, Method 509.1

### Safe Operating Area <sup>[a]</sup>



<sup>[a]</sup> Refer to Input Characteristics

### Typical Connection Diagram



## Storage

Vicor products, when not installed in customer units, should be stored in ESD safe packaging in accordance with ANSI/ESD S20.20, "Protection of Electrical and Electronic Parts, Assemblies and Equipment" and should be maintained in a temperature controlled factory/warehouse environment not exposed to outside elements controlled between the temperature ranges of 15°C and 38°C. Humidity shall not be condensing, no minimum humidity when stored in an ESD compliant package.

## Mechanical Drawing



Note: For alternate packaging options refer to the mechanical drawing page of vicorpower.com

<sup>[1]</sup> EMI performance is subject to a wide variety of external influences such as PCB construction, circuit layout etc. As such, external components in addition to those listed herein may be required in specific instances to gain full compliance to the standards specified.

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