



## 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<br>CE101, CE102<br>MIL-STD-461C<br>MIL-STD-461D/E                |
| Conducted susceptibility | CS01, CS02, CS06,<br>CS101, CS114, CS115, CS116<br>MIL-STD-461C<br>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<br>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,<br>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<br>17°C per minute rate of change | 12 cycles<br>-65°C to +100°C | 12 cycles<br>-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

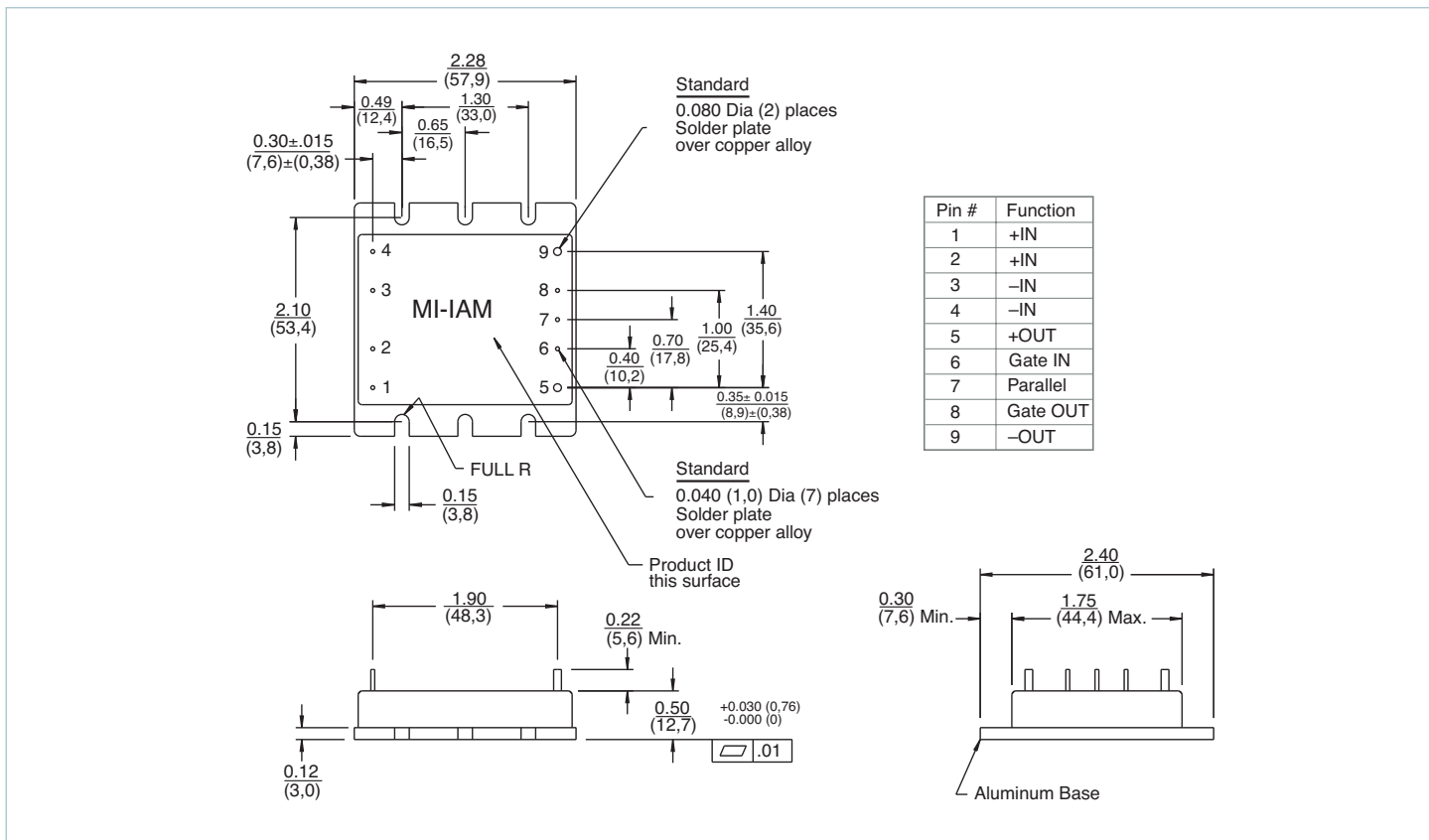
### Typical Connection Diagram



## 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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