Military Accessory
MI-IAM™

Input Attenuator Module

Features & Benefits

- Inputs: $28V_{DC}$ and $270V_{DC}$
- MIL-STD-461C/D/E EMI compliance [1]
- 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 Deseign 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 [1] 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_{BP} = 25°C, nominal line and 75% load, unless otherwise specified)

Parameter	Min	Typ	Max	Units	Notes
$28V_{DC}$ modules					
Steady state input	16	28	50	V_{DC}	
Input spike limit	-600		600	V_{DC}	20µs, 50Ω per MIL-STD-704A[a]
	-250		250	V_{DC}	70µs, 15mJ per MIL-STD-1275A/B/D
Input surge limit			100	V_{DC}	50ms, 0.5Ω per MIL-STD-1275A/B/D
			80	V_{DC}	100ms per DO-160E, Sec.16, Cat. Z
Overvoltage shut down[b]	50			V_{DC}	100ms, automatic recovery
Recommended fuse			20	Amps	F03A type
$270V_{DC}$ modules					
Steady state input	100	270	400	V_{DC}	
Input spike limit			800	V_{DC}	20µs, 50Ω [a]
	-600		600	V_{DC}	100µs, 50mJ [a]
Input surge limit			500	V_{DC}	100ms, 0.5Ω
Overvoltage shut down [a]	400			V_{DC}	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_{IN}	Steady state, I_{IN} 10ms

[a] Guaranteed by design – no test data available.
[b] 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					
$28V_{DC}$ input			60	V_{DC}	
$270V_{DC}$ input			420	V_{DC}	
Output power			250	Watts	
Internal voltage drop					
$28V_{DC}$		0.6		V_{DC}	
$270V_{DC}$		0.85		V_{DC}	
Overload protection					
$28V_{DC}$ input			20	Amps	Foldback threshold; auto recovery
$270V_{DC}$ 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[1]

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

[1] 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	$28V_{DC}$	16 – $50V_{DC}$	MI-22x-Mx and MI-J2x-Mx	M–grade
MI-A66-MU	$270V_{DC}$	125 – $400V_{DC}$	MI-26x-Mx and MI-J6x-Mx	M–grade
MI-A22-IU	$28V_{DC}$	16 – $50V_{DC}$	MI-22x-Ix and MI-J2x-Ix	I–grade
MI-A66-IU	$270V_{DC}$	125 – $400V_{DC}$	MI-26x-Ix and MI-J6x-Ix	I–grade

Specifications

(Typical at T_{BP} = 25°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		°C/Watt	
Operating temperature, baseplate			100	°C	See product grade specifications
Storage temperature			125	°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 [a]	-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

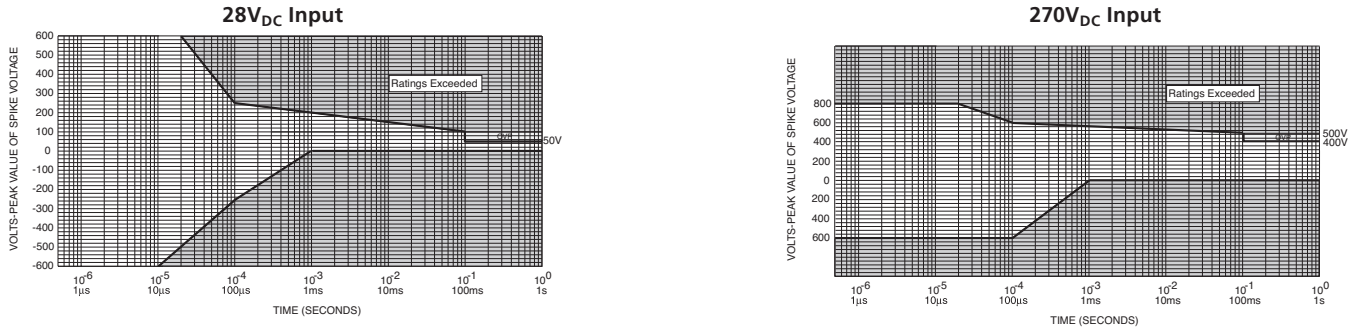
[a] Test data available for review or download from vicorpower.com

Specifications (Cont.)

ENVIRONMENTAL QUALIFICATIONS

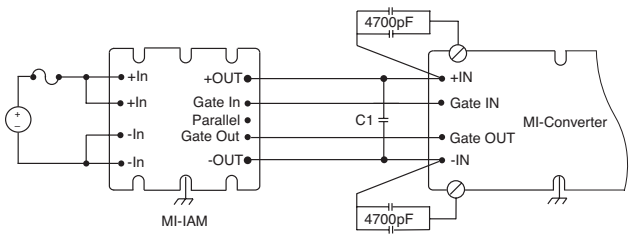
Parameter	Qualification
Altitude	MIL-STD-810D, Method 500.2, Procedure III, explosive decompression (40K ft.).
	MIL-STD-810D, Method 500.2, Procedure II, 40,000ft., 1000 – 1500ft./min. to 70,000ft., unit functioning
Explosive Atmosphere	MIL-STD-810C, Method 511.1, Procedure I
Vibration	MIL-STD-810D, Method 514.3, Procedure I, category 6, helicopter, 20g
	MIL-STD-810D, Method 514.3 random: 10 – 300Hz @ $0.02g^2$/Hz, 2000Hz @ $0.002g^2$/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 [a]



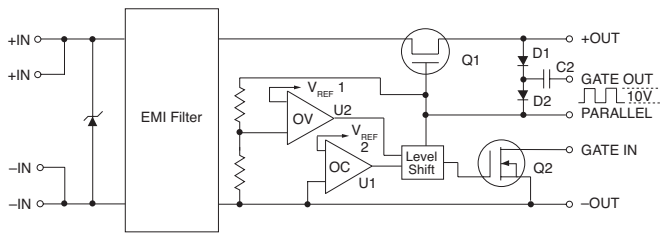
[a] Refer to Input Characteristics

Typical Connection Diagram



Input Voltage Range Capacitance (C1)

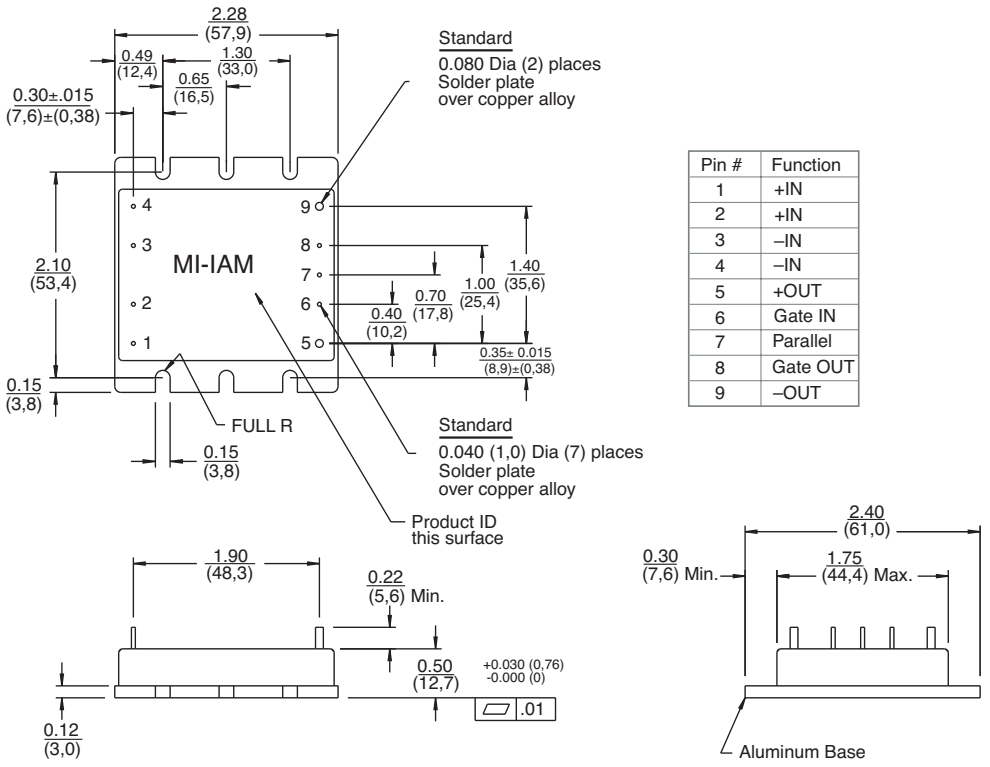
$28V_{DC}$ (18.8-50V)	390µF (Max.)
$270V_{DC}$ (125-400V)	27µF (Max.)



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



Pin #	Function
1	+IN
2	+IN
3	–IN
4	–IN
5	+OUT
6	Gate IN
7	Parallel
8	Gate OUT
9	–OUT

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

[1] 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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Specifications are subject to change without notice.

Visit http://www.vicorpower.com/mil-cots_dc-dc/mil-cots_mi-iam_input_attenuator_module for the latest product information.

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