

Actual size:  
2.28 x 2.2 x 0.5in  
57,9 x 55,9 x 12,7mm



## Filter Input Attenuator Module

### Features & Benefits

- RoHS Compliant (with F or G pin style)
- EMI filtering-EN50121-3-2 <sup>[1]</sup>
- Transient protection-EN50155, EN50121-3-2
- Low profile mounting options
- 500W output power
- 60950-1 compliance
- Mini-size package
- Inrush current limiting

### Product Highlights

The FIAM110 is a DC front-end module designed for rail applications providing transient protection, inrush current limiting and EMI filtering (EN50121-3-2) in a Mini-size package. The FIAM enables designers using Vicor 110V<sub>IN</sub> Mini, Micro, or Maxi or VI/VE-200 and VI/VE-J00 (T input) DC-DC converters to meet the transient immunity and EMI requirements required for the rail industry and protect system hardware from inrush current. The FIAM110 accepts an input voltage of 66 – 154V<sub>DC</sub> and provide up to 500W of output power and remote on/off control.

The FIAM110 is housed in an industry standard “half brick” module measuring 2.28” x 2.2” x 0.5” and depending upon model selected, may be mounted on-board or in-board for height critical applications.

### Compatible Products

- Mini, Micro, Maxi 110V Input DC-DC converters
- VI / VE-200, VI / VE-J00 (“T” input)

<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.

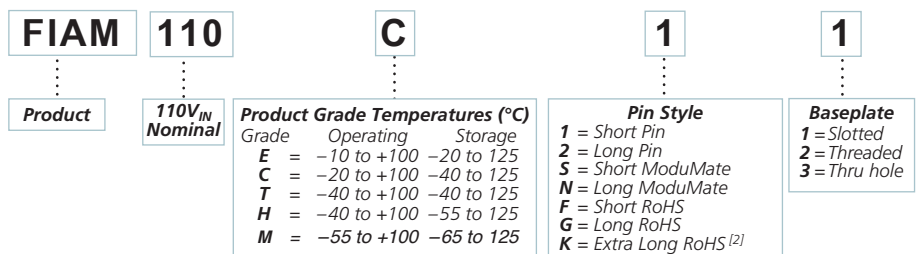
### Absolute Maximum Rating

Parameter	Rating	Unit	Notes
+IN to –IN	154	V <sub>DC</sub>	Continuous
	385	V	20ms
+OUT to –OUT	154	V <sub>DC</sub>	Continuous
Mounting torque	5 (0.57)	in-lbs	6 each, #4-40 or M3
Operating temperature	– 55 to +100	°C	M-Grade
Storage temperature	– 65 to +125	°C	M-Grade
Pin soldering temperature	500 (260)	°F (°C)	<5sec; wave solder
	750 (390)	°F (°C)	<7sec; hand solder

### Thermal Resistance

Parameter	Min	Typ	Max	Unit
Baseplate to sink				
	flat, greased surface		0.16	°C/Watt
	thermal pad (P/N 20264)		0.14	°C/Watt
Baseplate to ambient				
	Free Convection		8.0	°C/Watt
	1000LFM		1.9	°C/Watt

### Part Numbering



<sup>[2]</sup> Not intended for socket or Surfmate mounting

## Specifications

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

### INPUT SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Input voltage	66	110	154	$V_{DC}$	Continuous
Inrush limiting			0.06	$\text{A}\mu\text{F}$	
Transient immunity			176	$V_{DC}$	Consistent with 100ms per NF F 01-510
			165	$V_{DC}$	Consistent with 1s per RIA 12
			385	$V_{DC}$	Consistent with 20ms per RIA 12

### OUTPUT SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Output power			500	W	Output power derates linearly below $77V_{IN}$ to $400W @ 66V_{IN}$
Efficiency		98		%	
Internal Voltage Drop			2.5	V	500W at $25^{\circ}\text{C}$ baseplate
External capacitance			100	$\mu\text{F}$	

### CONTROL PIN SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
ON / OFF control					
Enable (ON)	0.0		1.0	$V_{DC}$	Referenced to $-V_{OUT}$
Disable (OFF)	3.5		5.0	$V_{DC}$	100k $\Omega$ internal pull-up resistor

### EMI

Standard	Notes
EN50121-3-2	150kHz to 500kHz - 99dB $\mu\text{V}$ quasi-peak 500kHz to 30MHz - 93dB $\mu\text{V}$ quasi-peak

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.

### IMMUNITY

Parameter	Typ. Value	Units	Notes
EN50121-3-2 (Table 7.3 Surges)	$\pm 2,000$	$V_{DC}$	Waveform – 1.2 / 50 $\mu\text{s}$ , 42 $\Omega$ , 0.5 $\mu\text{F}$ , line to ground
	$\pm 1,000$	$V_{DC}$	Waveform – 1.2 / 50 $\mu\text{s}$ , 42 $\Omega$ , 0.5 $\mu\text{F}$ , line to line Performance Criteria B - no damage to the product but a temporary change in the intended DC voltage is acceptable as long as it self-recovers without user intervention.
EN50121-3-2 (Table 7.2 Fast Transients)	$\pm 2,000$	$V_{DC}$	5/50ns, 5kHz Performance Criteria A - no damage to the product and no change to the intended DC voltage level for a duration greater than 1.0 $\mu\text{sec}$ .
EN50121-3-2 (Table 7.1 RF Common Mode)			0.15 to 80MHz, 10 $V_{RMS}$ , 80% AM, 1kHz Performance Criteria A - no damage to the product and no change to the intended DC voltage level greater than +/-5%.

### SAFETY SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Notes
Dielectric withstand (I/O to baseplate)		1,000		$V_{RMS}$	
		1,414		$V_{DC}$	

## Specifications (Cont.)

## AGENCY APPROVALS

Safety Standards	Markings	Notes
UL60950-1, CSA60950-1, EN60950-1, IEC 60950-1 EN60950-1	cTUVus CE	Pending Low Voltage Directive

## GENERAL SPECIFICATIONS

Parameter	Min	Typ	Max	Unit	Remarks
Weight		3.1 (88)	4 (113)	ounces (grams)	
Warranty			2	years	

## MODULE ENVIRONMENTAL QUALIFICATION

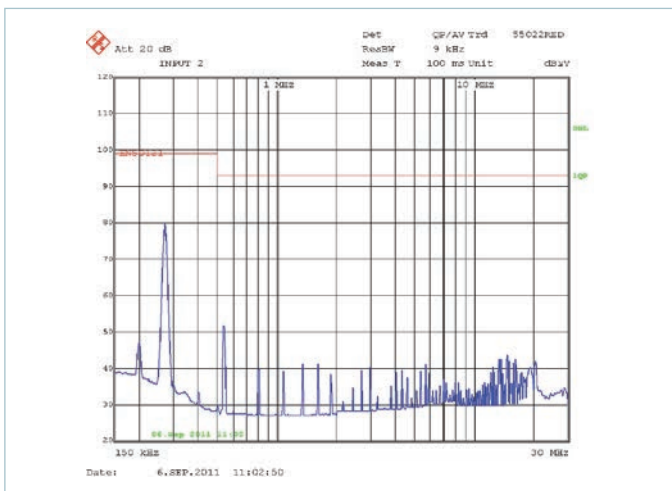
<b>Altitude</b> MIL-STD-810F, Method 500.4, Procedure I & II, 40,000ft. and 70,000ft. Operational.
<b>Explosive Atmosphere</b> MIL-STD-810F, Method 511.4, Procedure I, Operational.
<b>Vibration</b> EN 61373, Random Vibration: Category <0.3Kg, Freq range: 5-150Hz @ 5grms, 5hrs per axis. MIL-STD-810F, Method 514.5, Procedure I, Category 14, Sine and Random vibration per Table 514.5C for Helicopter AH-6J Main Rotor with overall level of 5.6Grms for 4 hours per axis. MIL-STD-810F, Method 514.5C, General Minimum Integrity Curve per Figure 514.5C-17 with overall level of 7.7Grms for 1 hour per axis.
<b>Shock</b> EN 61373, Shock: Long. / Trans. / Vert. Axis, peak acceleration: 5g / 2g / 1g, Duration: 50ms/ 20ms. MIL-STD-810F, Method 516.5, Procedure I, Functional Shock, 40g. MIL-S-901D, Lightweight Hammer Shock, 3 impacts/axis, 1,3,5 ft. MIL-STD-202F, Method 213B, 60g, 9ms half sine. MIL-STD-202F, Method 213B, 75g, 11ms Saw Tooth Shock.
<b>Acceleration</b> MIL-STD-810F, Method 513.5, Procedure II, table 513.5-II, Operational, 2-7g, 6 directions.
<b>Humidity</b> MIL-STD-810F, Method 507.4.
<b>Solder Test</b> MIL-STD-202G, Method 208H, 8 hour aging.

## MODULE ENVIRONMENTAL STRESS SCREENING

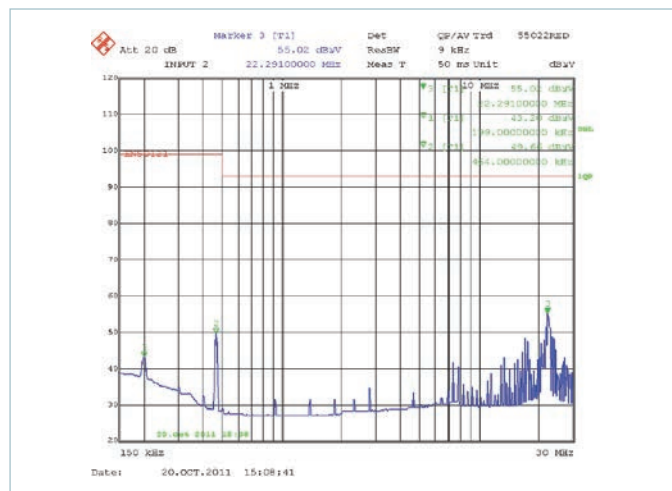
Parameter	H-Grade	M-Grade
Operating temperature	-40°C to +100°C	-55°C to +100°C
Storage temperature	-55°C to +125°C	-65°C to +125°C
Temperature cycling*	12 cycles -65°C to +100°C	12 cycles -65°C to +100°C
Ambient test @ 25°C	Yes	Yes
Power cycling burn-in	12 hours, 29 cycles	24 hours, 58 cycles
Functional and parametric ATE tests	-40°C and +100°C	-55°C and +100°C
Hi-Pot test	Yes	Yes
Visual inspection	Yes	Yes
Test data	<a href="http://vicorpower.com">vicorpower.com</a>	<a href="http://vicorpower.com">vicorpower.com</a>

\*Temperature cycled with power off, 17°C per minute rate of change.

## Conducted Noise

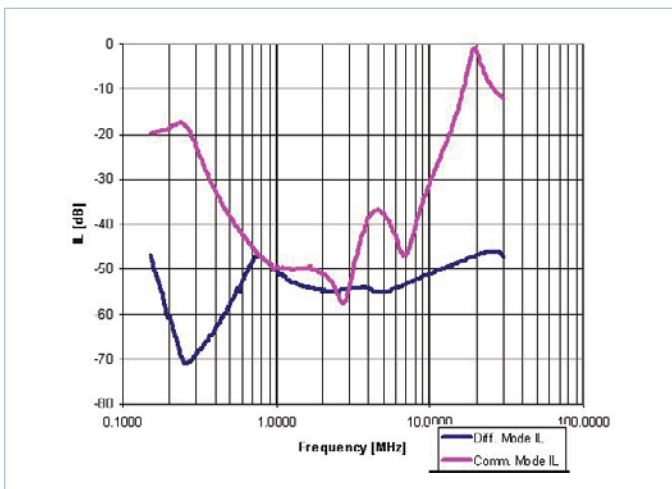


**Figure 1** — Conducted Noise (EN50121-3-2); FIAM110M21 and model V110A24C400BG DC-DC converter operating at 110V<sub>DC</sub> 375W.



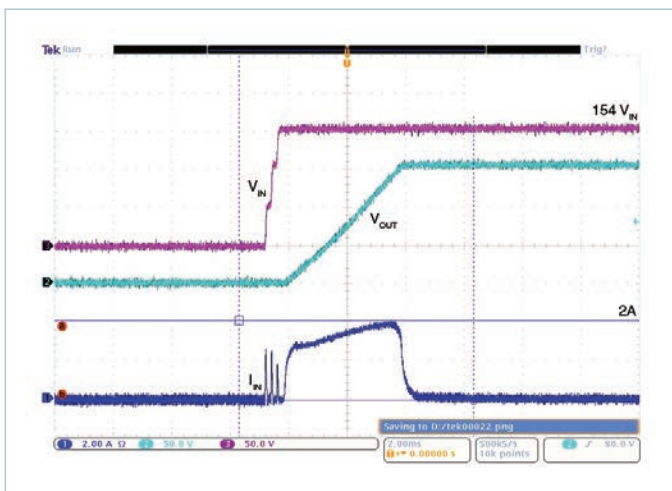
**Figure 2** — Conducted Noise (EN50121-3-2); FIAM110M21 and model VE-2T3-EW + (3) VI-BT3-IW DC-DC converters operating at 110V<sub>DC</sub> 375W.

## Insertion Loss



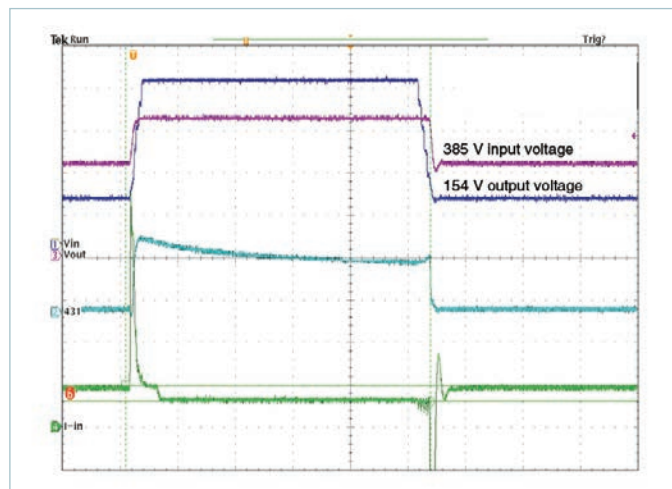
**Figure 3** — Insertion loss curve.

## Inrush Limiting



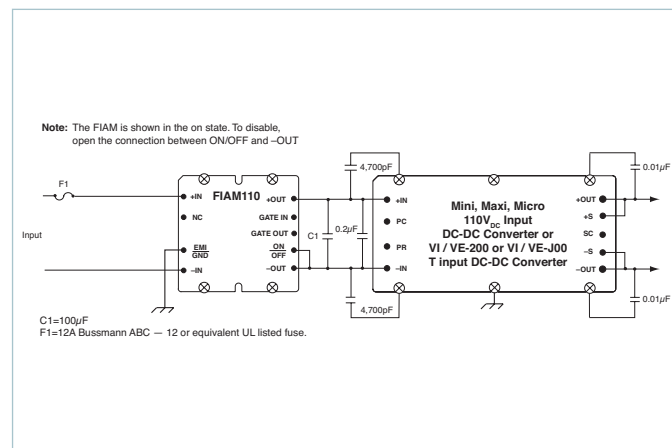
**Figure 5** — Inrush current. (100μF external capacitance)

## Transient Immunity



**Figure 4** — Transient Immunity: FIAM output response to an input transient.

## Transient and Surge Protection



**Figure 6** — Typical connection diagram

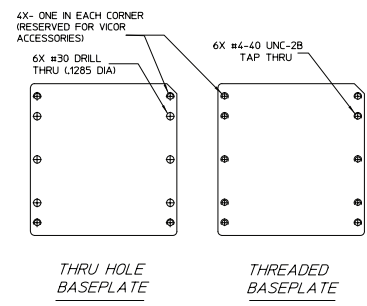
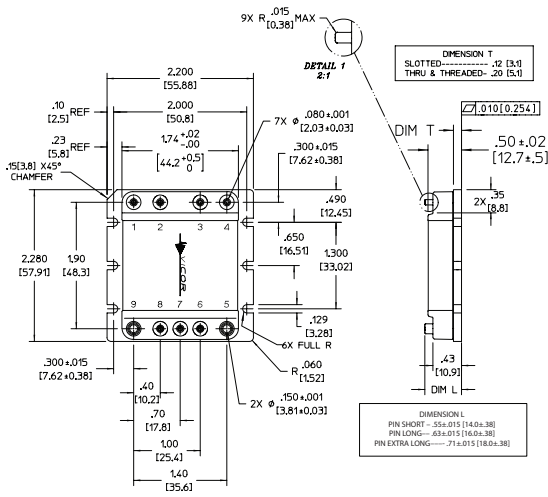
Storage

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 Diagram

Converter Pins		
No.	Function	Label
1	+IN	+
2	No Connection	NC
3	Ground	EMI/GND
4	-IN	-
5	-OUT	-
6	ON/OFF	ON/OFF
7	*	G <sub>OUT</sub> /NC
8	*	G <sub>IN</sub> /NC
9	+OUT	+

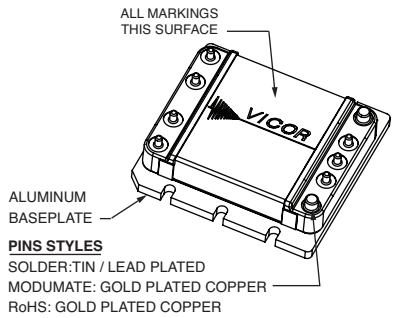
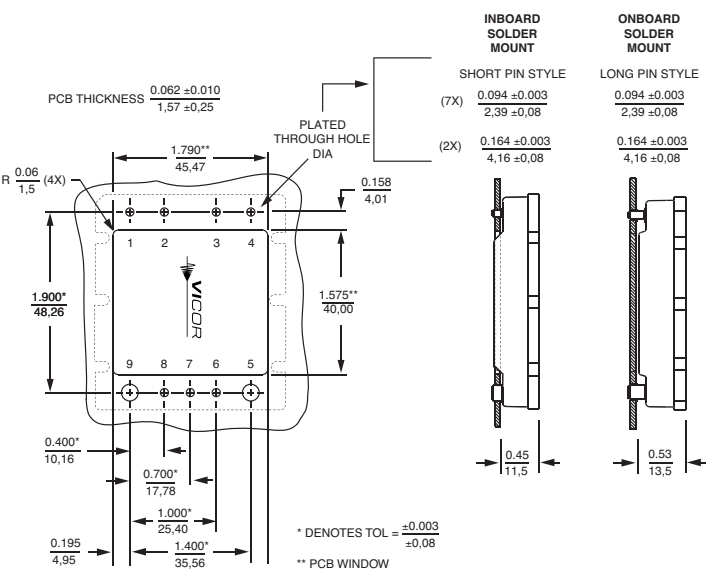
\* VI/VE-200/J00 modules only connect to respective pins. Otherwise, do not connect.



NOTES:  
 1. MATERIAL:  
 BASE: 6000 SERIES ALUMINUM  
 COVER: LCP ALUMINUM 3003 H14  
 PINS: ROHS PINS GOLD PLATE 30 MICRO INCH MIN; NON-ROHS  
 PINS: TINLEAD 90/10 BRIGHT  
 2. DIMENSIONS AND VALUES IN BRACKETS ARE METRIC  
 3. MANUFACTURING CONTROL IS IN PLACE TO ENSURE THAT THE SPACING BETWEEN THE MODULES LABEL SURFACE TO THE PRINTED CIRCUIT BOARD OF THE APPLICATION RANGES FROM DIRECT CONTACT (ZERO), TO THE MAXIMUM GAP AS CALCULATED FROM THE TOLERANCE STACK-UP AND IS NOT SUBJECT NEGATIVE TOLERANCE ACCUMULATION

**SLOTTED BASEPLATE**  
 DIMENSIONS FOR ALL MODULE TYPES ARE SHOWN ABOVE, VERSIONS AT RIGHT SHOW DIMENSIONS THAT VARY

PCB Mounting Specifications



Consult Vicor Application Note: Soldering methods and procedures for 1st and 2nd Generation modules.

**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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