Military COTS 28V_{IN} Filter

M-FIAM9

Example Model Number **M-FIAM9M21**

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

Input Attenuator Module

Features & Benefits

- EMI filtering: MIL-STD-461E [b]
- Transient protection: MIL-STD-704A/E/F, MIL-STD-1275A/B/D
- Environments: MIL-STD-810, MIL-STD-202
- Environmental stress screening
- Low-profile mounting options
- Output power up to 500W
- Output current up to 18A
- Mini-sized package
- Inrush current limiting

Product Highlights

The M-FIAM9 is a DC front-end module that provides EMI filtering and transient protection. The M-FIAM9 enables designers using Vicor 24V or 28V DC-DC converters to meet conducted emission / conducted susceptibility per MIL-STD-461E; and input transients per MIL-STD-704A/E/F and MIL-STD-1275A/B/D. The M-FIAM9 accepts an input voltage of 10 – 36V_{DC} and delivers output power up to 500W.

M-FIAM9 is housed in an industry-standard "half-brick" module measuring 2.28 x 2.2 x 0.5in and depending upon model selected, may be mounted onboard or inboard for height-critical applications.

Compatible Products

- Maxi, Mini, Micro Series 24V and 28V Input DC-DC converters or VIPAC Arrays™

Absolute Maximum Rating

Parameter	Rating	Unit	Notes
+IN to –IN	36	V_{DC}	Continuous
	100	V_{DC}	50ms, See Figure 1
	250	V_{DC}	70µs
Mounting torque	5 [0.57]	in·lbs [N·m]	6 each, #4-40 or M3
Pin soldering temperature	500 [260]	°F [°C]	<5sec; wave solder
	750 [390]	°F [°C]	<7sec; hand solder

Thermal Resistance and Capacity

Parameter	Min	Typ	Max	Unit
Baseplate to sink				
flat, greased surface		0.16		°C/Watt
with thermal pad (P/N 20264)		0.1		°C/Watt
Baseplate to ambient				
Free convection		7.9		°C/Watt
1000LFM		2.2		°C/Watt

MTBF per MIL-HDBK-217F (M-FIAM9M21)

Temperature	Environment	MTBF	Unit
25°C	Ground Benign: G.B.	3,582	1,000Hrs
50°C	Naval Sheltered: N.S.	644	1,000Hrs
65°C	Airborne Inhabited Cargo: A.I.C.	505	1,000Hrs

Part Numbering

M-FIAM9 | **M** | **2** | **1**

Product

Product Grade Temperatures (°C)

Grade	Operating	Storage
H =	–40 to +100	–55 to +125
M =	–55 to +100	–65 to +125

Pin Style
1 = Short Pin
2 = Long Pin
S = Short ModuMate [a]
N = Long ModuMate [a]
F = Short RoHS
G = Long RoHS
K = Extra Long RoHS [c]

Baseplate
1 = Slotted
2 = Threaded
3 = Thru hole

[a] Compatible with SurfMate and InMate socketing system.
[b] 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.
[c] Not intended for socket or Surfmate mounting.

Note: Product images may not highlight current product markings.

Specifications

Typical at T_{BP} = 25°C, nominal line and 75% load, unless otherwise specified.

Input Specifications

Parameter	Min	Typ	Max	Unit	Notes
Input voltage	10	28	36	V_{DC}	Continuous
Inrush limiting			0.007	A/µF	Intended for use in Military Ground Vehicles where the power available is per MIL-STD-1275D. Internal capacitance is ~50µF, which precedes the inrush limit circuit. External precautions should be taken if the source cannot tolerate the capacitive charge current associated with this internal capacitance.
Transient immunity			100	V_{DC}	50ms per MIL-STD-1275A/B/D, continuous operation
			250	V_{DC}	70µs per MIL-STD-1275A/B/D, continuous operation
			70	V_{DC}	20ms per MIL-STD-704A, continuous operation
			50	V_{DC}	12.5ms per MIL-STD-704E/F, continuous operation

Output Specifications

Parameter	Min	Typ	Max	Unit	Notes
Output power			500	W	See Figures 5 & 6
Output current			18	A	
Efficiency	96	97		%	
Internal voltage drop		0.85	1.5	V	500W, 25°C baseplate
External capacitance					See Figure 7 on page 5
	330		1000	µF	50V

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}	100kΩ internal pull-up resistor

Safety Specifications

Parameter	Min	Typ	Max	Unit	Notes
Dielectric withstand	1,500			V_{RMS}	Input/Output to Base
	2,121			V_{DC}	Input/Output to Base

EMI

Standard	Test Procedure	Notes
MIL-STD-461E		
Conducted emissions:	CE101, CE102	When using with V28 series converters a 27µH inductor is needed between the filter and converter for compliance below 30% of rated power.
Conducted susceptibility:	CS101, CS114, CS115, CS116	

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.

Specifications (Cont.)

Typical at T_{BP} = 25°C, nominal line and 75% load, unless otherwise specified.

General Specifications

Parameter	Min	Typ	Max	Unit	Notes
Weight			3.3 [94]	Ounces [grams]	
Warranty			2	Years	
Agency Approvals				CE	CE Marked to the Low Voltage Directive and RoHS Recast Directive, as applicable
				UKCA	Electrical equipment (safety) regulations

Environmental Qualification

Altitude
MIL-STD-810F, Method 500.4, Procedure I & II, 40,000ft. and 70,000ft. Operational.

Explosive Atmosphere
MIL-STD-810F, Method 511.4, Procedure I, Operational.

Vibration
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.

Shock
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.

Acceleration
MIL-STD-810F, Method 513.5, Procedure II, table 513.5-II, Operational, 2-7g, 6 directions.

Humidity
MIL-STD-810F, Method 507.4.

Solder Test
MIL-STD-202G, Method 208H, 8 hour aging.

Environmental Stress Screening

Parameter	H-Grade	M-Grade
Operating temperature	–40 to +100°C	–55 to +100°C
Storage temperature	–55 to +125°C	–65 to +125°C
Temperature cycling*	12 cycles –65 to +100°C	12 cycles –65 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 and +100°C	–55 and +100°C
Hi-Pot test	Yes	Yes
Visual inspection	Yes	Yes
Test data	vicorpower.com	vicorpower.com

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

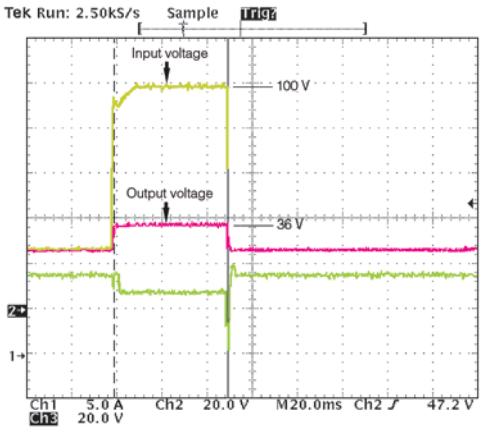


Figure 1 — *Transient immunity: M-FIAM9 output response to an input transient*

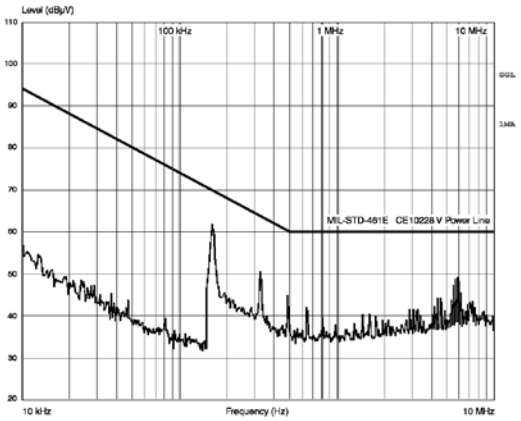


Figure 2 — *Conducted noise: M-FIAM9 and model V28A12M200B DC-DC converter operating at 28V_{DC}, 200W*

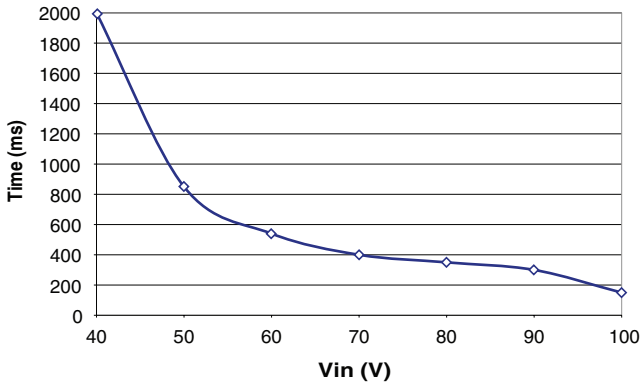


Figure 3 — *Shut-down time of M-FIAM9 vs. overvoltage*

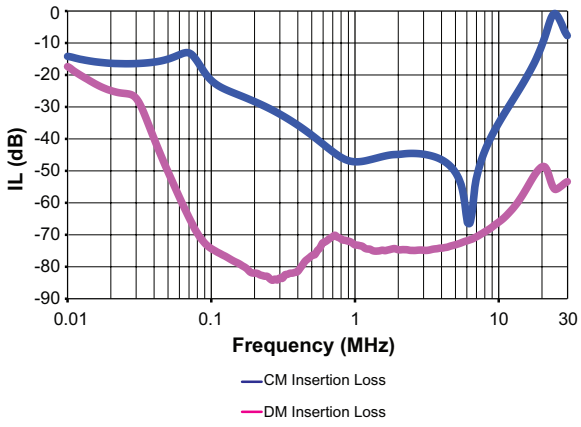


Figure 4 — *M-FIAM9 insertion loss*

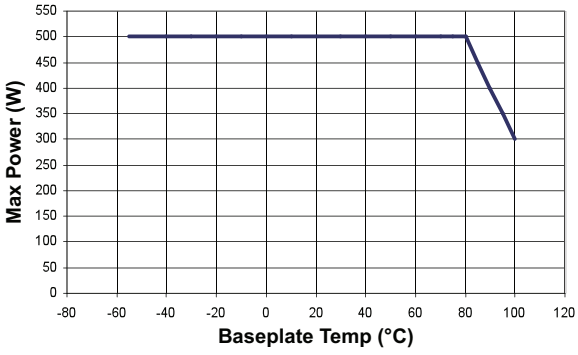


Figure 5 — *Temperature de-rating*

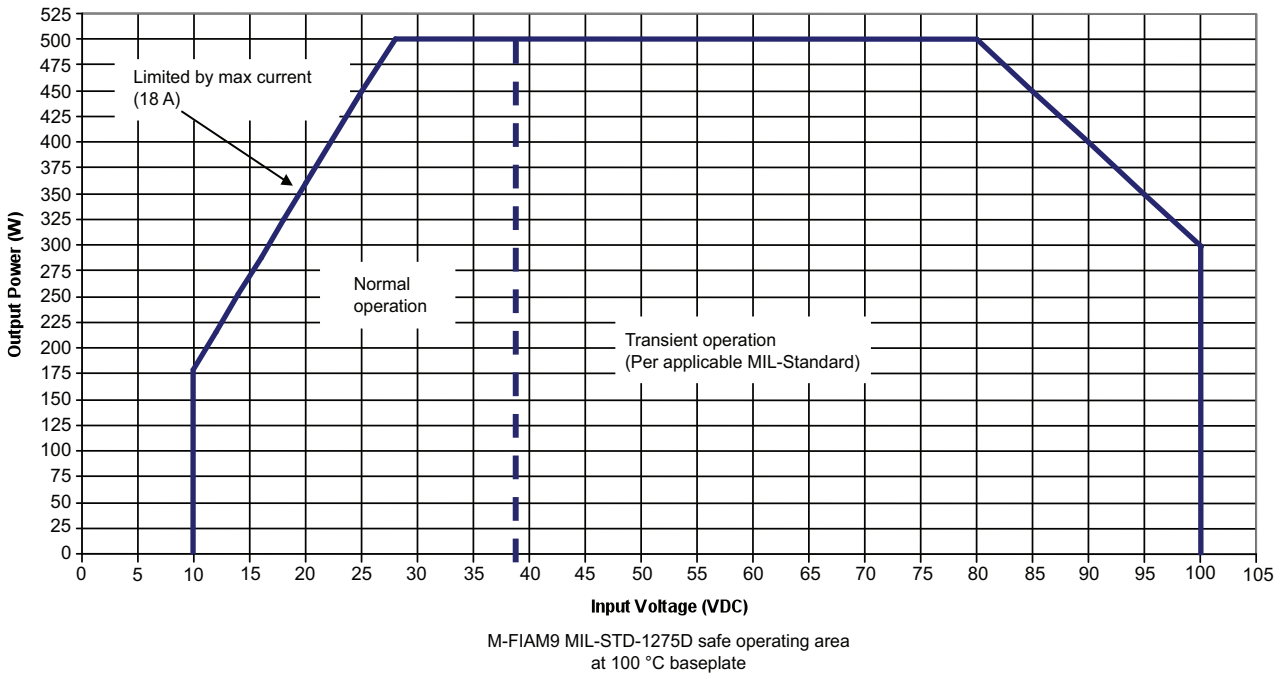


Figure 6 — *M-FIAM 9 transient safe operating area at 100°C baseplate*

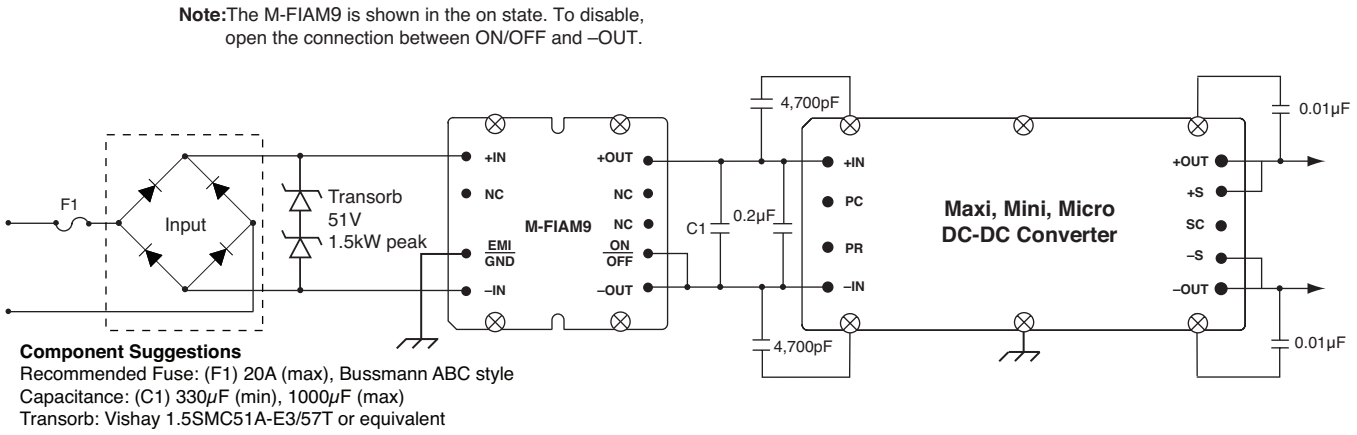


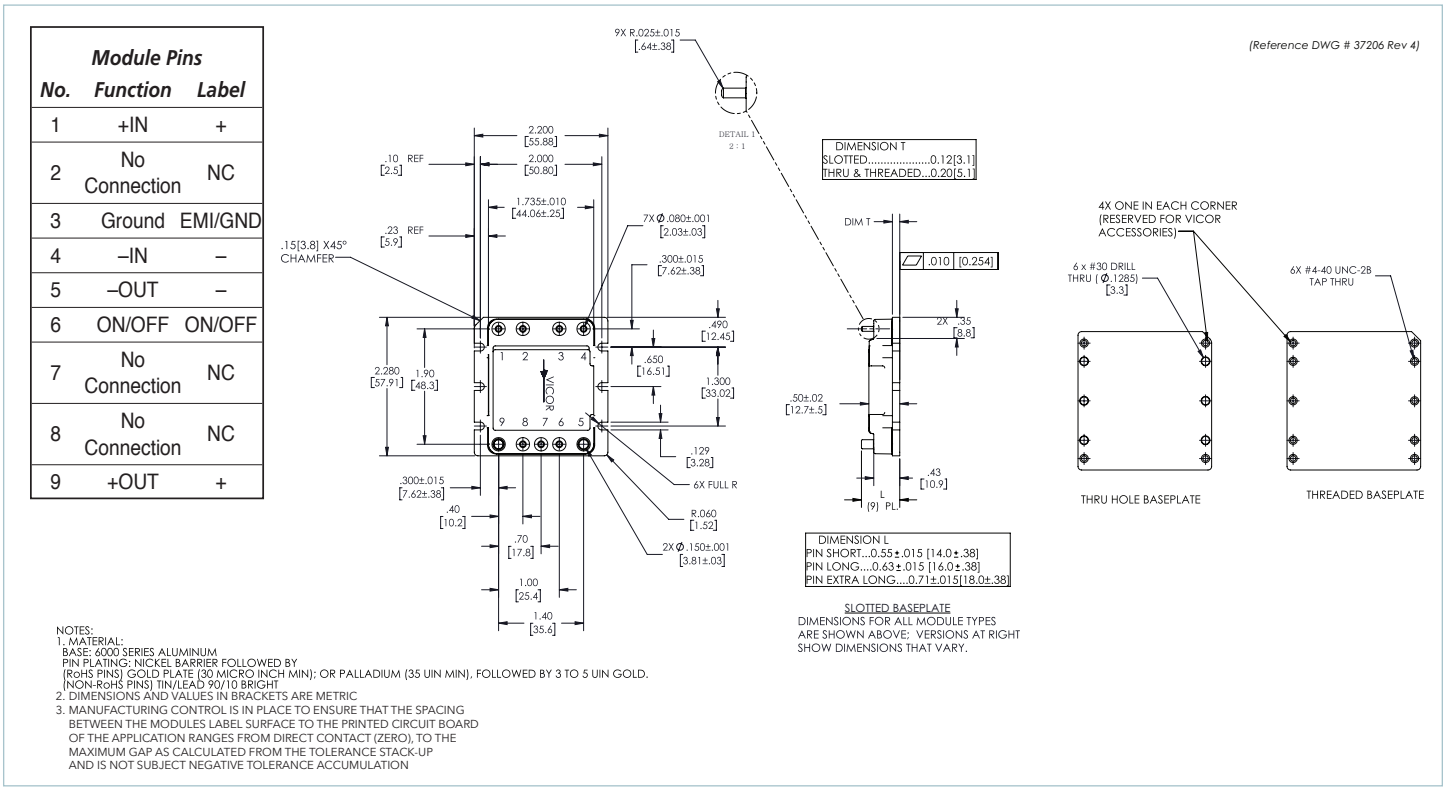
Figure 7 — *Transient, surge protection and recommended reverse-polarity protection*

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 Drawings

Module Pins		
No.	*Function*	*Label*
1	+IN	+
2	No Connection	NC
3	Ground	EMI/GND
4	–IN	–
5	–OUT	–
6	ON/OFF	ON/OFF
7	No Connection	NC
8	No Connection	NC
9	+OUT	+



NOTES:
1. MATERIAL:
BASE: 6000 SERIES ALUMINUM
PIN PLATING: NICKEL BARRIER FOLLOWED BY
(RoHS PINS) GOLD PLATE (30 MICRO INCH MIN); OR PALLADIUM (35 UIN MIN), FOLLOWED BY 3 TO 5 UIN GOLD.
(NON-RoHS PINS) TIN/LEAD 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

Figure 8 — *Mechanical diagram*

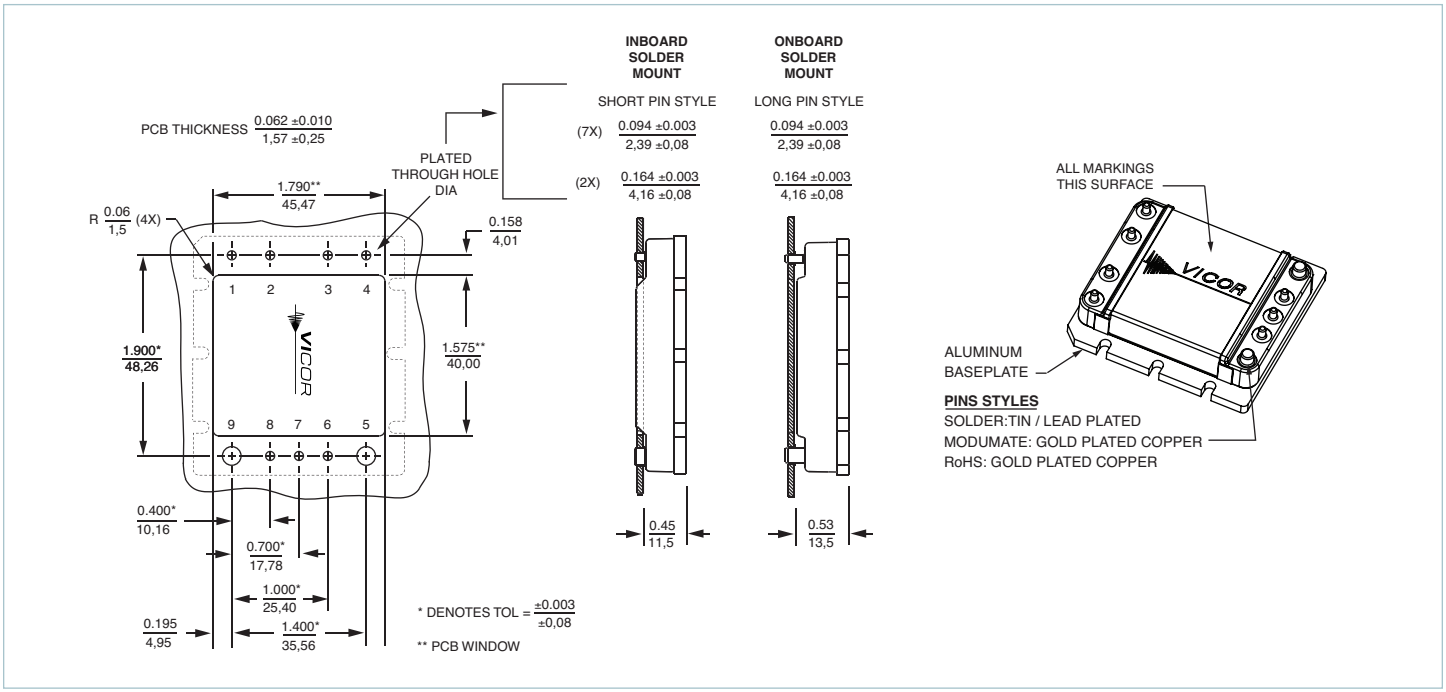


Figure 9 — *PCB mounting specifications*

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.

Information furnished by Vicor is believed to be accurate and reliable. However, no responsibility is assumed by Vicor for its use. Vicor makes no representations or warranties with respect to the accuracy or completeness of the contents of this publication. Vicor reserves the right to make changes to any products, specifications, and product descriptions at any time without notice. Information published by Vicor has been checked and is believed to be accurate at the time it was printed; however, Vicor assumes no responsibility for inaccuracies. Testing and other quality controls are used to the extent Vicor deems necessary to support Vicor's product warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

Specifications are subject to change without notice.

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

Vicor's Standard Terms and Conditions and Product Warranty

All sales are subject to Vicor's Standard Terms and Conditions of Sale, and Product Warranty which are available on Vicor's webpage (http://www.vicorpower.com/termsconditionswarranty) or upon request.

Life Support Policy

VICOR'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE CHIEF EXECUTIVE OFFICER AND GENERAL COUNSEL OF VICOR CORPORATION. As used herein, life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness. Per Vicor Terms and Conditions of Sale, the user of Vicor products and components in life support applications assumes all risks of such use and indemnifies Vicor against all liability and damages.

Intellectual Property Notice

Vicor and its subsidiaries own Intellectual Property (including issued U.S. and Foreign Patents and pending patent applications) relating to the products described in this data sheet. No license, whether express, implied, or arising by estoppel or otherwise, to any intellectual property rights is granted by this document. Interested parties should contact Vicor's Intellectual Property Department.

Contact Us: http://www.vicorpower.com/contact-us

Vicor Corporation
25 Frontage Road
Andover, MA, USA 01810
Tel: 800-735-6200
Fax: 978-475-6715
www.vicorpower.com

email
Customer Service: custserv@vicorpower.com
Technical Support: apps@vicorpower.com