

Description

The FIAM family of front-end modules (Figure 11.1) provides EMI filtering, transient protection and inrush current limiting in DC-DC applications. The FIAM enables designers using Vicor Maxi, Mini, and Micro DC-DC converters, and in select cases VI Chip®-based devices, to meet the transient immunity and EMI requirements of the standards referenced in the respective model data sheet.

Theory of Operation

Refer to the simplified FIAM block diagram Figure 11.2.

Internally, the FIAM employs a transient suppressor directly across the input. A passive EMI filter that is tuned to attenuate both common-mode and differential-mode conducted emissions follow this.

When the FIAM ON / OFF control pin is tied to –OUT the device is set to “ON” and will provide an output upon application of input voltage.

When power is applied, the charge pump / control circuit drives the gate of the MOSFET in series with the positive rail (Q1). The charge pump limits the time rate of change of the gate bias voltage, which results in a controlled voltage ramp up – this limits the rate at which the external output capacitor is charged, thereby limiting the system inrush current.

During normal operation Q1 is fully enhanced – essentially a closed switch.

Surge protection is accomplished by robbing gate charge of the Q1 by the bottom MOSFET Q2. During this condition, the source terminal of the Q1 follows the gate, offset by the gate threshold voltage. A transient surge event at the input, or drain terminal of the Q1 is therefore attenuated and absorbed by Q1 while in the source follower mode. As a result, the transient surge is not propagated to the output of the FIAM.

Removing the ON / OFF connection shuts down the charge pump and turns off Q1.

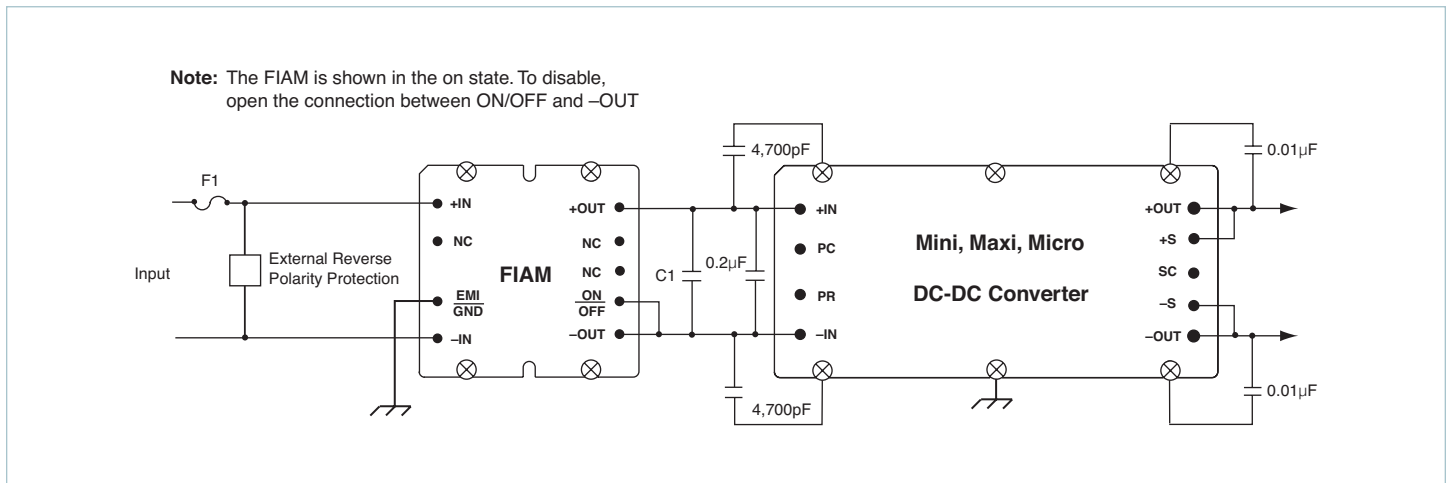


Figure 11.1 — Typical application (FIAM)

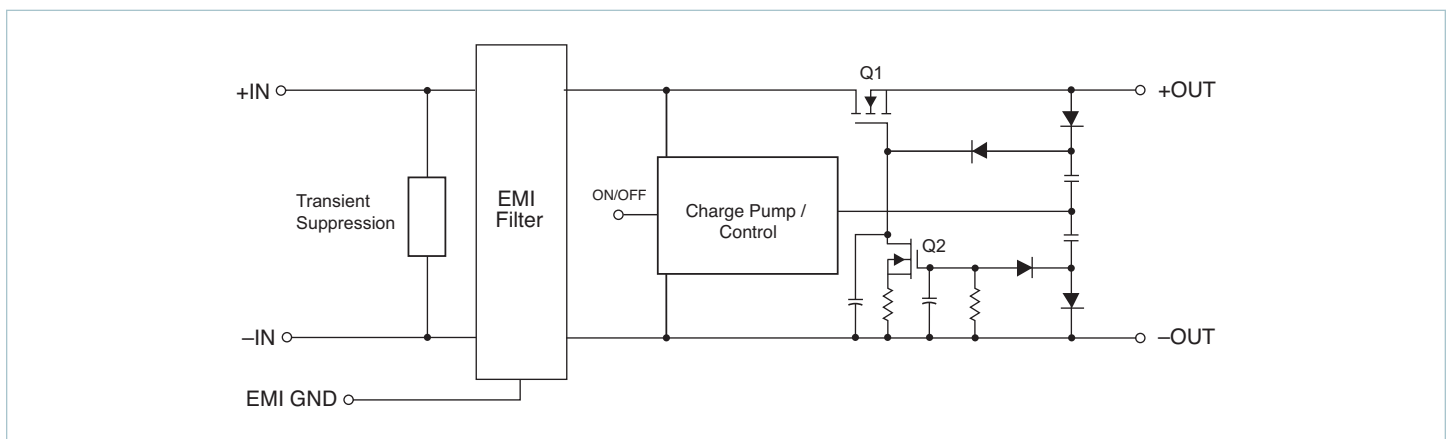


Figure 11.2 — Block diagram (FIAM)

Parameter	FIAM1	FIAM2	M-FIAM3
Input Voltage (Continuous)	36 – 76V _{DC}	36 – 76V _{DC}	180 – 375V _{DC}
Recommended Fusing (F1)	Bussman ABC-10	Bussman ABC-20	Bussman ABC-3
Output Current (Maximum)	10A	20A	3A
External Capacitance (C1)	10µF min – 150µF max	100µF min – 330µF max	10µF min – 22µF max
Inrush Limiting (Maximum)	0.014A/µF	0.014A/µF	0.018A/µF
EMI / RFI	Bellcore GR-001089-Core, EN55022 Class B, FCC Part 15 Class B	Bellcore GR-001089-Core, EN55022 Class B, FCC Part 15 Class B	MIL-STD-461E, CE101, CE102, CS101, CS114, CS115, CS116
Transient Immunity	Bellcore TR-NWT-0004999, ETS 300 386-1, Class 2	Bellcore TR-NWT-0004999, ETS 300 386-1, Class 2	Exceeds limits of MIL-STD-704E/F
Mini Package Size	2.28 x 2.2 x 0.5in	2.28 x 2.2 x 0.5in	2.28 x 2.2 x 0.5in

Parameter	M-FIAM5B	M-FIAM9
Input Voltage (Continuous)	14 – 36V _{DC}	10 – 36V _{DC}
Recommended Fusing (F1)	Bussman ABC-20	Bussman ABC-20
Output Current (Maximum)	20A	18A
External Capacitance (C1)	330µF min – 1000µF max	330µF min – 1000µF max
Inrush Limiting (Maximum)	0.007A/µF	0.007A/µF
EMI / RFI	MIL-STD-461E, CE101, CE102, CS101, CS114, CS115, CS116	MIL-STD-461E, CE101, CE102, CS101, CS114, CS115, CS116
Transient Immunity	50V Max. 12.5ms per MIL-STD-704E/F, cont. operation	100V _{DC} 50ms per MIL-STD 1275A/B/D, 250V _{DC} 70µs per MIL-STD-1275A/B/D, 70V _{DC} 20ms per MIL-STD-704A, 50V _{DC} 12.5ms per MIL-STD-704E/F, cont. operation
Mini Package Size	2.28 x 2.2 x 0.5in	2.28 x 2.2 x 0.5in

Table 11.1 — FIAM family specifications (see specific data sheets for more detail)

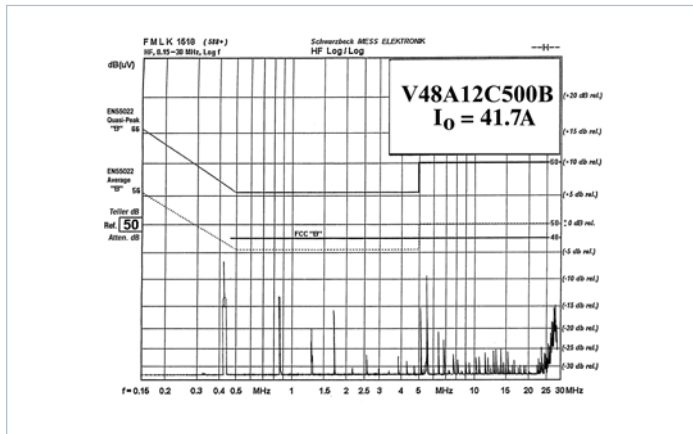


Figure 11.3 — FIAM and model V48A12C500B DC-DC converter conducted emissions typical

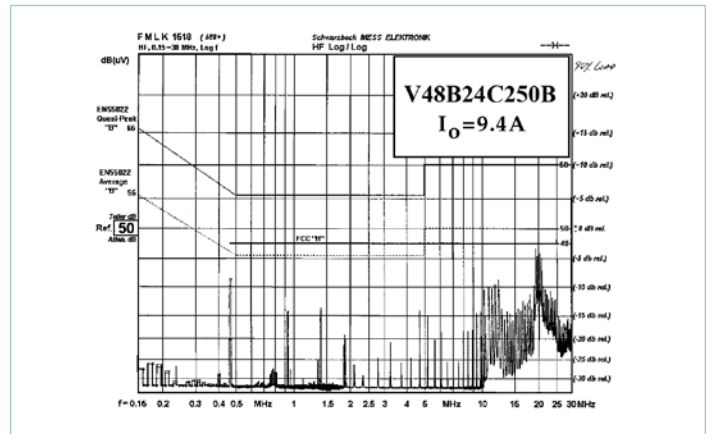


Figure 11.4 — FIAM and model V48B24C250B DC-DC converter conducted emissions typical

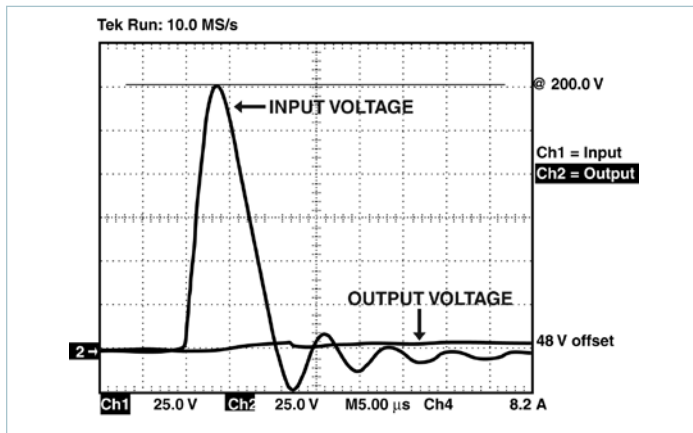


Figure 11.5 — Transient immunity: FIAM output response to an input transient typical

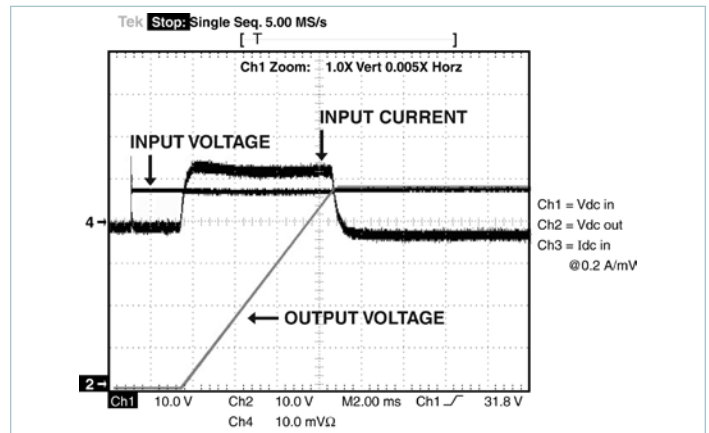


Figure 11.6 — Inrush limiting: Inrush current with 330μF external capacitance typical