HV MFM™ Filter

MFM3314xD2KD2F0yzz

High-Voltage MIL-COTS Input Filter Module

Features & Benefits

- 270V nominal input
- 99% efficiency
- EMI filtering
  - MIL-STD-461E/F/G, selected CE and CS tests
- Input transient protection
  - MIL-STD-704E/F (MIL-HDBK-704-8) Normal and abnormal transients
- Envronmental qualification
  - MIL-STD-810
  - MIL-STD-202
- Low M-Grade temperature rating, providing operation down to –55°C
- Output power up to 600W

Typical Applications

- Defense
- Aerospace

Compatible Products

- High-input-voltage ChiP DCM, 160 – 420V_{DC} (270V nominal input)

Product Description

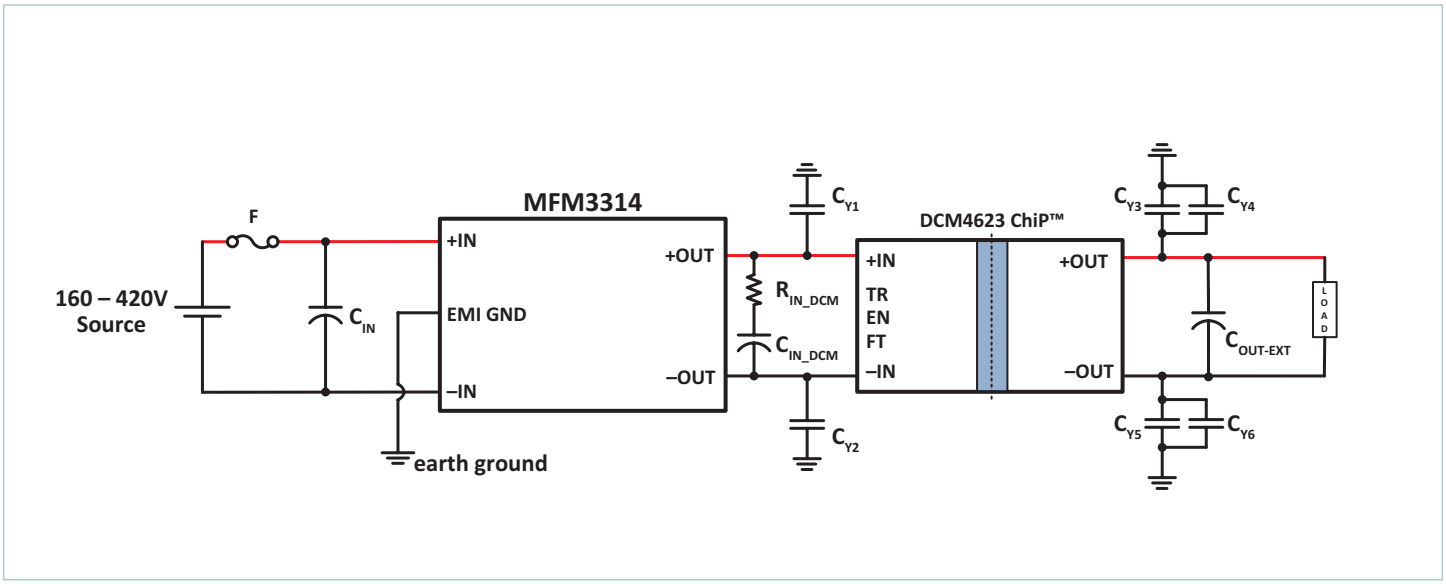
The MFM Filter is a DC front-end module that provides EMI filtering and transient protection. The MFM DCM™ Filter enables designers using Vicor 270V nominal input voltage ChiP™ modules to meet conducted emission/conducted susceptibility per MIL-STD-461E/F/G; and input transients per MIL-STD-704A/F. The MFM Filter accepts an input voltage of 160 – 420V_{DC} (270V nominal input) and delivers output power up to 600W.

Package Information

- PCB-Mount VIA™ Package
  3.31 x 1.41 x 0.42in
  [84.04 x 35.93 x 10.57mm]
- Weight: 54g

Note: Product images may not highlight current product markings.

Typical Application



M-Grade DCM4623 with an MFM3314 input filter, to meet the EMI and transient requirements

Parts List for Typical Applications	
F	**Eaton** 505 Series, rated 10A **Littelfuse** 487 Series, rated 10A
C_{IN}	**TDK** C5750X6S2W225K250KA, 5x 2.2µF (11µF)
C_{IN_DCM}	**TDK** C5750X6S2W225K250KA, 2.2µF
R_{IN_DCM}	**Generic** 3.6Ω
C_{Y1}, C_{Y2}	**Murata** GA352QR7GF152KW01L, 1500pF
C_{Y3}, C_{Y4}, C_{Y5}, C_{Y6}	**Murata** GA355DR7GF472KW01L, 4700pF

Pin Configuration

MFM3314 Filter – PCB Mount – Pins Down

Note: This pin drawing is not to scale.

Pin Descriptions

Signal Name	Type	Function
+IN	INPUT POWER	Positive input power terminal
–IN	INPUT POWER RETURN	Negative input power terminal
EMI GND	EMI GROUND	EMI ground terminal
+OUT	OUTPUT POWER	Positive output power terminal
–OUT	OUTPUT POWER RETURN	Negative output power terminal

Part Ordering Information

Part Number	Package Type	Product Grade	Option Field
MFM3314**B**D2KD2F0**M08**	**B** = Board VIA	**M** = –55 to 100°C	**08** = Long Pin

Storage and Handling Information

Attribute	Comments	Specification
Operating Internal Temperature Range (T_{INT})	M-Grade	–55 to 125°C
Case Temperature		–55 to 100°C
Storage Temperature	M-Grade	–65 to 125°C
Soldering Temperature	See AN:401 PCB Mount VIA Soldering Guidelines	
Weight		54g
Pin Material		C145 copper, full hard
Underplate	Low-stress ductile nickel	50 – 100µin
Pin Finish	Palladium	0.8 – 6µin
	Soft Gold	0.12 – 2µin
Flatness		< 0.25mm [0.010in]

Safety, Reliability and Agency Approvals

Attribute	Comments	Value	Unit
Dielectric Withstand	Input / Output to EMI GND/Case	2500	V_{DC}
MTBF	MIL-HDBK-217FN2 Parts Count - 25°C Ground Benign, Stationary, Indoors / Computer	6.45	MHrs
Agency Approvals/Standards			
	CE Marked for Low Voltage Directive and RoHS Recast Directive, as applicable		

Absolute Maximum Ratings

The absolute maximum ratings below are stress ratings only. Operation at or beyond these maximum ratings can cause permanent damage to the device. Electrical specifications do not apply when operating beyond rated operating conditions.

Parameter	Comments	Min	Max	Unit
Input Voltage (+IN to –IN)	Continuous	–0.5	460.0	V
Output Voltage (+OUT to –OUT)	Continuous	–0.5	460.0	V
Dielectric Withstand (Input/Output to EMI GND/Case)			2500	V_{DC}
Average Output Current			4	A

Electrical Specifications

Specifications apply over all line and load conditions, unless otherwise noted; **boldface** specifications apply over the temperature range of –55°C ≤ T_{CASE} ≤100°C (M-Grade); all other specifications are at T_{CASE} = 25°C unless otherwise noted.

Attribute	Symbol	Conditions / Notes	Min	Typ	Max	Unit
Power Input / Output Specification						
Input Voltage Range	V_{IN}	Continuous operation	160	270	420	V
Maximum Output Current [a]	I_{OUT_MAX}	Continuous, at V_{OUT} = 160V ($I_{OUT} = P_{OUT}/V_{IN}$)			4	A
Rated Output Power [a]	P_{OUT}	Continuous, over all line conditions			600	W
Internal Voltage Drop		At 270V, 2.37A, 100°C baseplate			**1.6**	V_{DC}
Power Dissipation	P_D	Worst case; low line, full load			**6**	W

[a] One MFM for each ChiP™ DCM™ is required even if the total power of the DCM is below P_{OUT} maximum value.

EMI/EMC

Standard	Test Procedure	Notes
MIL-STD-461E/F/G		
Conducted Emmisions	CE101	Figure CE101-4, Navy ASW & Army Aircraft, Curve #1 (above 28V_{DC})
	CE102	Figure CE102-1, Basic curve + 10dB limit relaxation for all applications
Conducted Susceptibility	CS101	Figure CS101, Curve #1, for all applications (above 28V_{DC})
	CS114	Curve 5, Bulk Current Injection
	CS115	Figure CS115-1 for all applications, impulse excitation
	CS116	Figure CS116-2 for all applications, damped sinusoidal
MIL-HDBK-704-7		
Transient Immunity	MIL-STD-704F normal transients	From table HDC105-III: overvoltage 330V_{DC} for 20ms duration, undervoltage 200V_{DC} for 50ms duration
	MIL-STD-704F abnormal transients	From table HDC302-III: overvoltage 350V_{DC} for 50ms duration, undervoltage 180V_{DC} for 50ms duration

Thermal Specified Operating Area

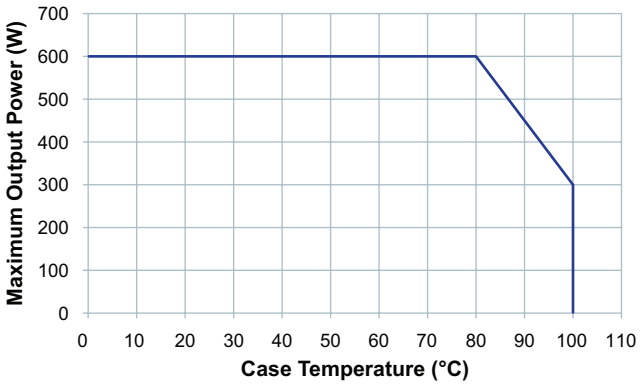


Figure 1 — *Thermal specified operating area: maximum output power vs. case temperature*

Typical Conducted Emissions

CE101 peak scans with MFM3314VD2KD2F0M00 and DCM4623TD2K31E0M00, in either condition: –OUT connected to GND or –OUT floating.

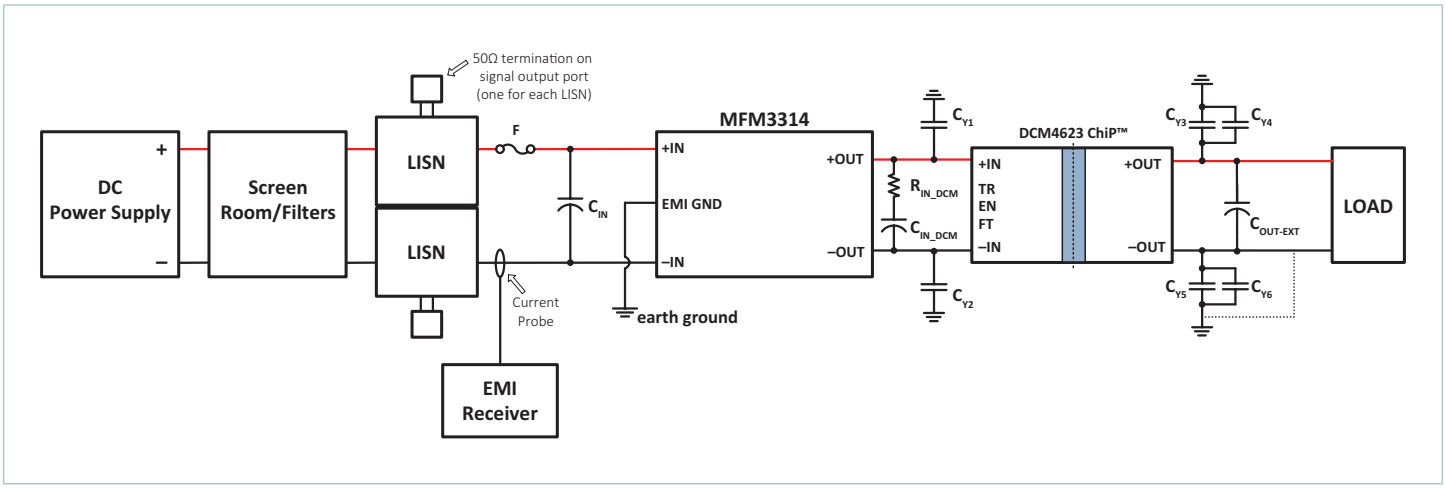


Figure 2 — *A typical test set up for conducted emissions CE101 is shown above. A current probe is used to measure and plot the variations in the current through the RED and BLACK leads at various load conditions.*

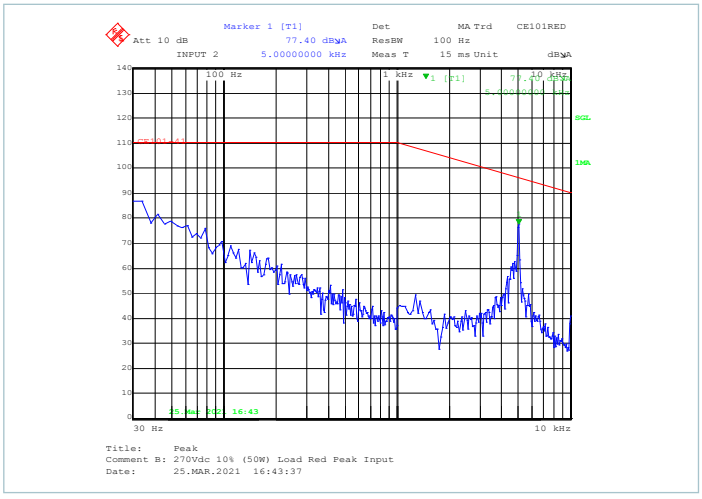


Figure 3 — *Peak scan for the RED lead, 10% load*

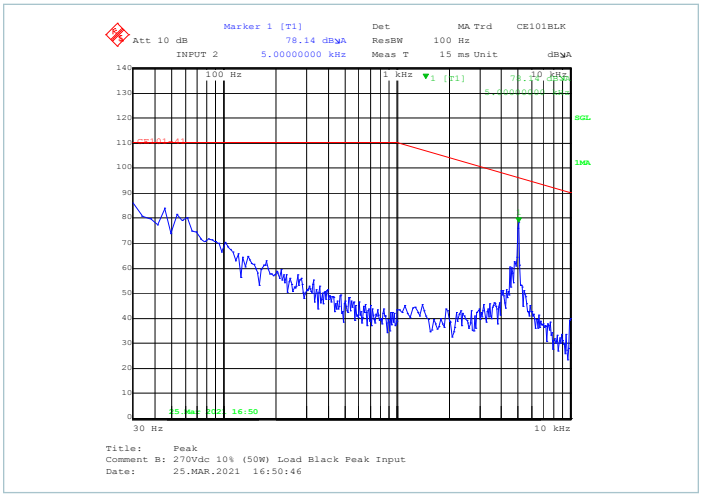


Figure 4 — *Peak scan for the BLACK lead, 10% load*

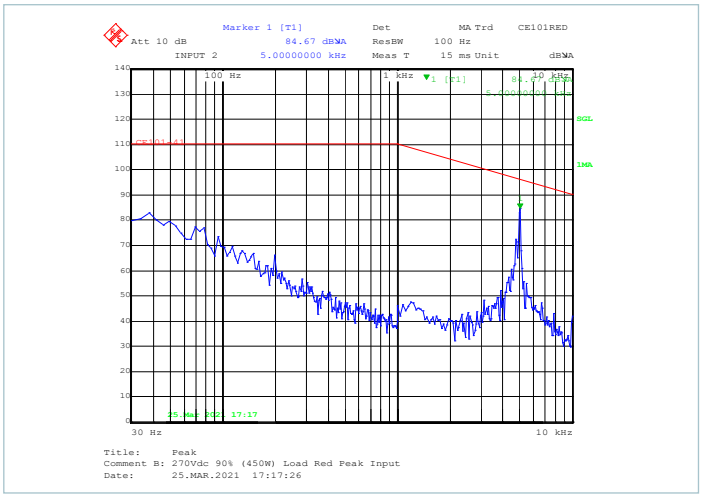


Figure 5 — *Peak scan for the RED lead, 90% load*

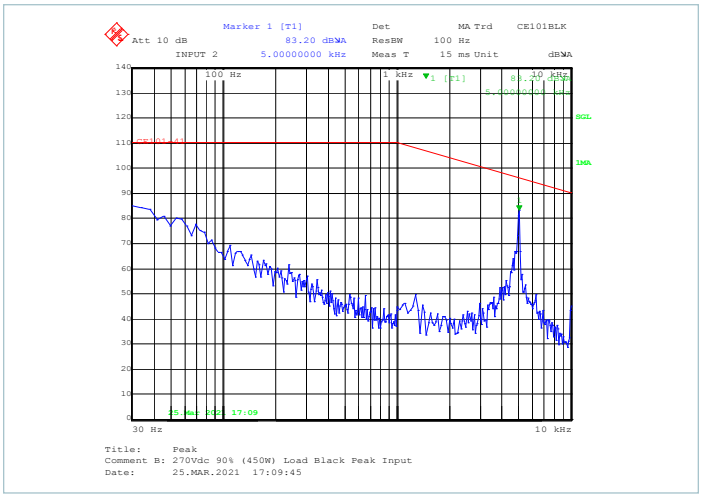


Figure 6 — *Peak scan for the BLACK lead, 90% load*

Typical Conducted Emissions (Cont.)

CE102 peak scans with MFM3314VD2KD2F0M00 and DCM4623TD2K31E0M00, in either condition: –OUT connected to GND or –OUT floating.

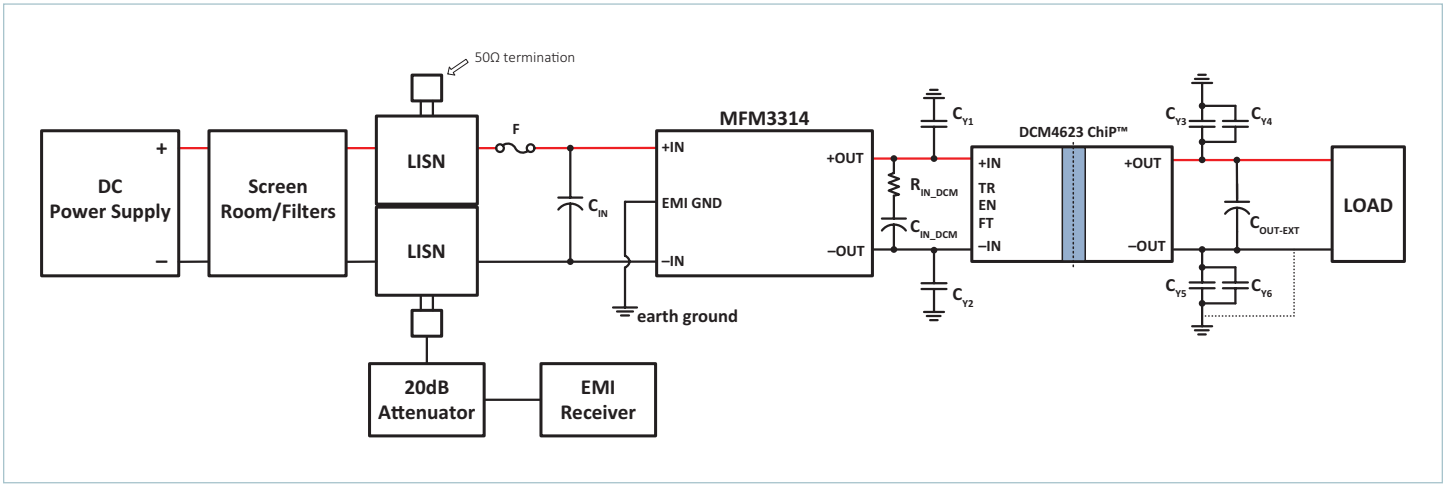


Figure 7 — *A typical test set up for conducted emissions CE102 is shown above. A 50Ω termination is used for LISN and voltage across the RED and BLACK leads are measured at various load conditions.*

Figure 8 — *Peak scan for the RED lead, 10% load*

Figure 9 — *Peak scan for the BLACK lead, 10% load*

Figure 10 — *Peak scan for the RED lead, 90% load*

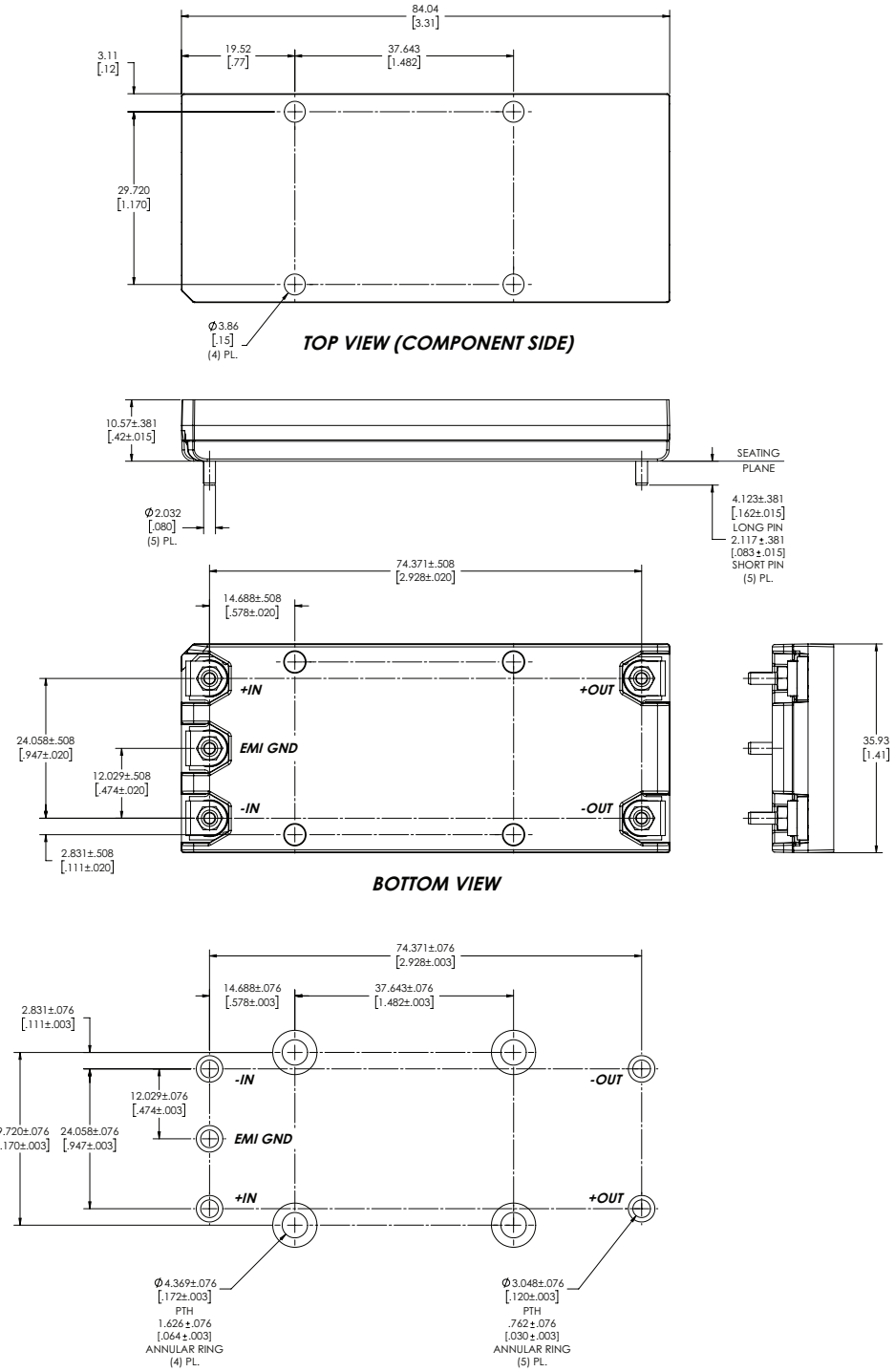
Figure 11 — *Peak scan for the BLACK lead, 90% load*

Environmental Qualification

Testing Activity	Reference Standard	Test Details
HTOB-HTOL High-Temperature Operating Bias/Life	JESD22-A110-B	Duration of 1000hrs, high line, full load, max operating temperature, power cycled per IPC9592
TC (Temperature Cycling)	JESD22-A104D	1000 cycles –55 to 125°C
HALT (Highly-Accelerated Life Test)	DP-0266	Low temp, high temp, rapid thermal cycling, random vibration test, combined stress test
THB (Temperature Humidity Bias)	JEDSD22-A101C	Duration of 1000hrs, biased, 85°C, 85%RH.
HTS (High-Temperature Storage)	JESD 22-A103-D	Duration 1000hrs, no bias. Maximum storage temperature (125°C)
LTS (Low-Temperature Storage)	JESD22–A119	Duration 1000hrs, no bias. Minimum storage temperature (–65°C)
Random Vibration	MIL-STD-810G	Method 514.6, Procedure I, Category 24, mounted on QA
Mechanical Shock	MIL-STD-810G	Method 516.5, Procedure I, Environment: functional shock 40G, mounted on QA
Electro Static Discharge Human Body Model	JEDEC JS-001-2012	Table 2B, Class 2, ±2000V minimum
Electro Static Discharge Device Charge Model	JESD22-C101-E	Class III ±500V minimum
Free Fall	IPC9592B	IEC 60068-2-32, Freefall Procedure 1
Term Strength	MIL-STD-202G	Method 211A, Test Condition A, Environment: ambient temperature & %Rh.
Through-Hole Solderability	IPC-9592B	IPC/ECA J-STD-002 Test A (dip and look)
Salt Fog	MIL-STD-810G	Method 509.5
Fungus	MIL-STD-810G	Method 508.6
Resistance to Solvents	MIL-STD-202G	Method 215K
Acceleration	MIL-STD-810G	Method 513.6 Procedure II
Altitude	MIL-STD-810G	Method 500.5 Procedure I & II
Explosive Atmosphere	MIL-STD-810G	Method 511.5 Procedure I, operational

Board-Mount Outline Drawing

MFM3314 Filter
(Reference DWG # 49456 Rev 1)



- UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE: INCH [MM]
- TOLERANCES ARE:
  DECIMALS:
    X.XX [X.XX] = ±0.25 [0.01]
    X.XXX [X.XXX] = ±0.127 [0.005]
  ANGLES = ±1°

Revision History

Revision	Date	Description	Page Number(s)
1.0	11/29/21	Initial release	n/a

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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

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