200W AC-DC Power Supply with PFC
CFM200M Series
APPLICATION NOTE

Approved By:

Department	Approved By	Checked By	Written By
Research and Development Department	Enoch	Wei-Cheng/Tab Ovid	Joyce
Quality Assurance Department	David	Benny	

CFM200M Series

Application Note V12 January 2018

Content

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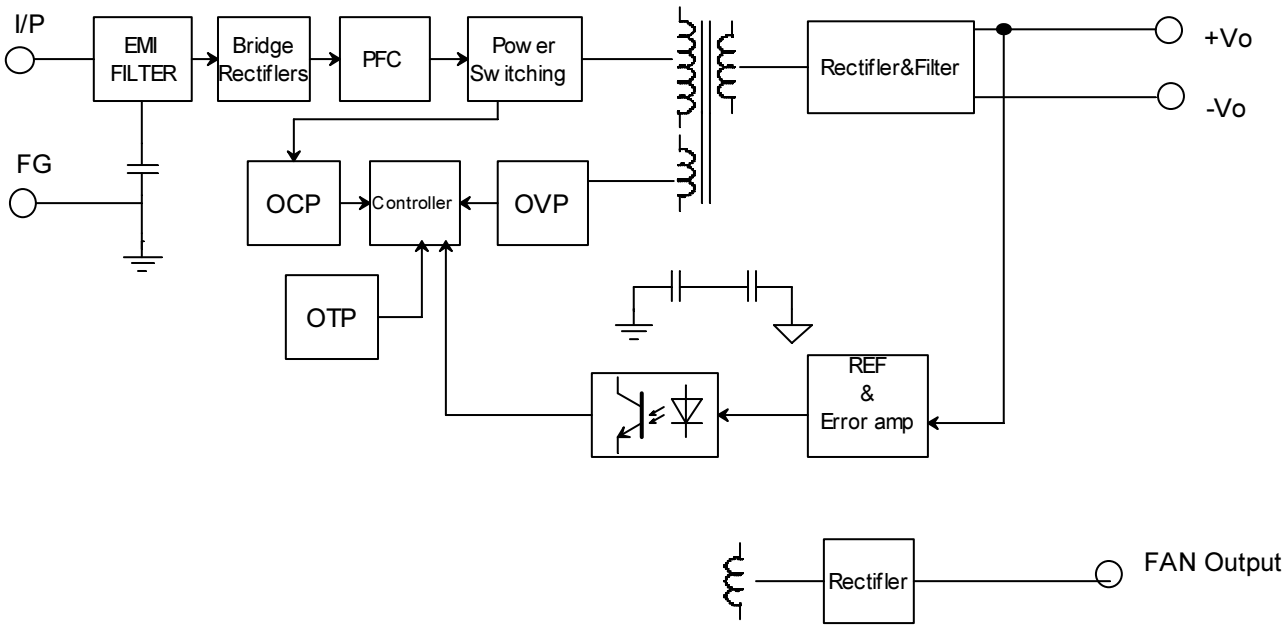
1. Introduction

This application note describes the features and functions of Cincon's CFM200M series of open frame, switching AC-DC power module. These are highly efficient, reliable, compact, high power density, single output AC/DC power modules. The module is fully protected against short circuit and over-voltage conditions. Cincon's world class automated manufacturing methods, together with an extensive testing and qualification program, ensure that the CFM200M series power module is extremely reliable.

2. Features

- Universal Input Range 90~264Vac
- 2"x 4" Compact Size/CFM200M
- 180W with Natural Convection @ 220Vac/CFM200M
- 200W with Natural Convection @ 220Vac/CFM200MXXXC
- Meets EN55011 and EN55022 Class B
- Meets 2MOPP
- Active PFC Meets EN61000-3-2
- High Efficiency up to 93.5% Typical
- High Power Density Up to 16.9W/Inch^3 /CFM200M
- 12V fan output
- No Load Input Power Consumption < 0.3W
- Meet Class II & Class I

3. Electrical Block Diagram



4. Technical Specifications

(All specifications are typical at nominal input, full load at 25℃ unless otherwise noted.)

ABSOLUTE MAXIMUM RATINGS						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
Input Voltage (Continuous)		All	90		264	Vac
Operating Temperature	See derating curve	All	-20		+60	℃
Storage Temperature		All	-40		+85	℃
Input/Output Isolation Voltage	1 minute	All	4000			Vac
INPUT CHARACTERISTICS						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
Operating Voltage Range		All	100		240	Vac
Input Frequency Range		All	47		63	Hz
Maximum Input Current	100% Load, Vin=100Vac	All			2.5	A
Leakage Current (Earth)		All		260	300	uA
Leakage Current (Touch)		CFM200MXXXC		75	100	uA
Under Voltage Protection		All	69		83	V
OUTPUT CHARACTERISTICS						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
Output Voltage Set Point	Vin=Nominal Vin, Io=Io .max, Tc=25℃.	CFM200M120/120C CFM200M240/240C CFM200M480/480C	11.76 23.52 47.04	12 24 48	12.24 24.48 48.96	Vdc
Operating Output Current Range		CFM200M120/120C CFM200M240/240C CFM200M480/480C			16.67 8.33 4.17	A
Holdup Time	Vin=115Vac	All		10		ms
Output Voltage Regulation						
Load Regulation	20% load to full load	All			±1.0	%
Line Regulation	Vin=high line to low line	All			±0.5	%
Over Current Protection		All	130	150	180	%
Over Voltage Protection		CFM200M120/120C CFM200M240/240C CFM200M480/480C		16 31 56		VDC
Output Ripple and Noise	1. Add a 0.1uF ceramic capacitor and a 47uF aluminum electrolytic capacitor to output. 2. Oscilolscope is 20MHz band width. 3. Ambient temperature=25℃	CFM200M120/120C CFM200M240/240C CFM200M480/480C			150 240 480	mVp-p
Load Capacitance	1. Input voltage is 115VAC and 230VAC 2. Output is max. load	CFM200M120/120C CFM200M240/240C CFM200M480/480C			16400 8570 1270	uF
Efficiency	1. Input voltage is 230VAC 2. Output is max. load	CFM200M120/120C CFM200M240/240C CFM200M480/480C		92 93.5 93		%

ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input to Output	1 minute (without dielectric breakdown)	All			4000	Vac
Input to Earth(Ground)	1 minute (without dielectric breakdown)	All			1500	Vac
Output to Earth(Ground)	1 minute (without dielectric breakdown)	All			500	Vac
Isolation Resistance		All	100			MΩ

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency		All		85		KHz

GENERAL SPECIFICATIONS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
MTBF	Io=100%; Ta=25℃ per MIL-HDBK-217F	All		279		K hours
Weight		CFM200MXXX CFM200MXXXC		253 314		g
Safety	Class I & Class II, IEC60601-1, EN60601-1, ANSI/AAMI ES60601-1				ED 3.1	
EMC Emission	EN55011, Class B, IEC61000-3-2:2014, IEC61000-3-3:2013, FCC CFR 47 Part 18 Subpart C, Oct. 2015				ED 4.0	
Conducted disturbance	EN55011, FCC CFR 47 Part 18				Class B	
Radiated disturbance	EN55011, FCC CFR 47 Part 18 Class I,(Class II see Section 7.5)				Class B	
Harmonic current emissions	IEC 61000-3-2:2014,				Class A, Class D	
Voltage fluctuations & flicker	IEC 61000-3-3:2013,				Criteria A	
EMC Immunity	IEC61000-4-2,3,4,5,6,8,11					
Radio-frequency, Continuous radiated disturbance	IEC 61000-4-3:2010				Criteria A	
Electrical fast transient (EFT)	IEC 61000-4-4:2012, ±0.5kv, ±1kv, ±2kv				Criteria A	
Surge	IEC 61000-4-5:2014, L-N: ±0.5kv, ±1kv, L-PE, N-PE: ±0.5kv, ±1kv, ±2kv				Criteria A	
Conducted disturbances, induced by RF fields	IEC 61000-4-6:2013				Criteria A	
Power frequency magnetic field	IEC 61000-4-8:2009				Criteria A	
Voltage dips	IEC 61000-4-11:2004, Dip: 30% 500ms, Dip: 60% 100ms, Dip >95% 10ms				Criteria A	
Voltage interruptions	IEC 61000-4-11:2004, >95% 5000ms				Criteria B	
Voltage interruptions	IEC 61000-4-11:2004, >95% 5000ms					

5. Main Features and Functions

5.1 Operating Temperature Range

The highly efficient design of Cincon's CFM200M series power modules has resulted in their ability to operate within ambient temperature environments from -20℃ to 60℃. Due consideration must be given to the de-rating curves when ascertaining the maximum power that can be drawn from the module. The maximum power which can be drawn is influenced by a number of factors, such as

- Input voltage range
- Permissible Output load (per derating curve)
- Effective heat sinks

5.2 Output Protection (Over Current Protection)

The power modules provide full continuous short-circuit protection. The unit will auto recover once the short circuit is removed. To provide protection in a fault condition, the unit is equipped with internal over-current protection. The unit will operate normally once the fault condition is removed. The power module will go to hiccup mode if the output current is set from 130% to 180% of rated current.

6. EMC & Safety

■ Emission and Immunity (Ed. 4.0)

EN55011 Class B, FCC CFR47 Part 18, IEC61000-3-2, 3, IEC61000-4-2, 3, 4, 5, 6, 8, 11

■ Safety (Ed. 3.1)

IEC60601-1:2005+A1:2012

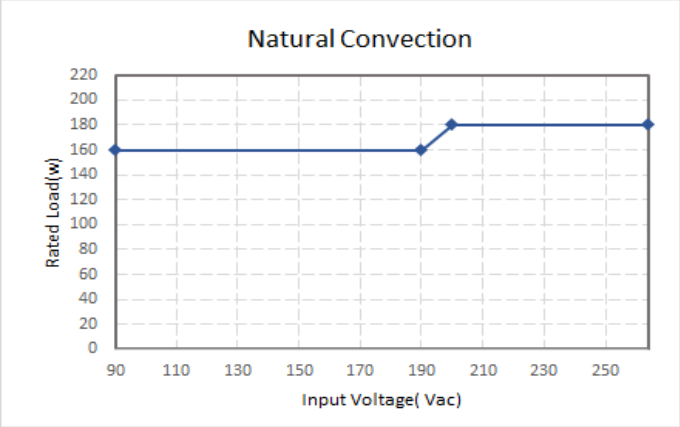
EN60601-1:2006+A11:2011+A1+A12

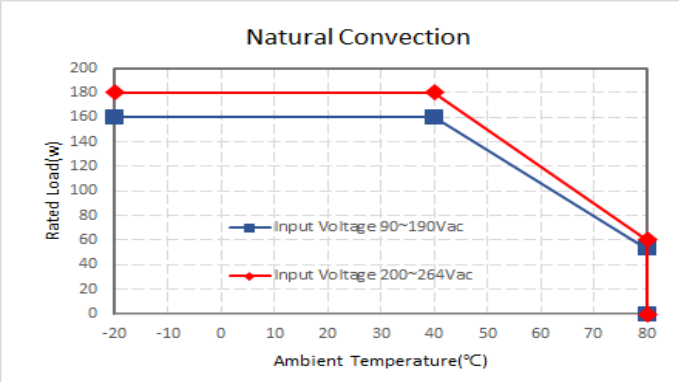
UL ANS/AAMI ES60601-1

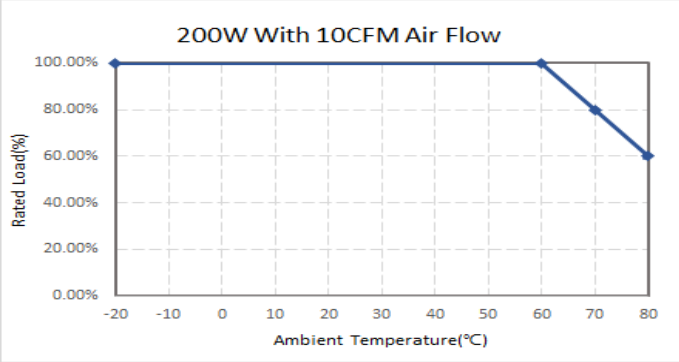
7. Applications

7.1 Power De-Rating Curve

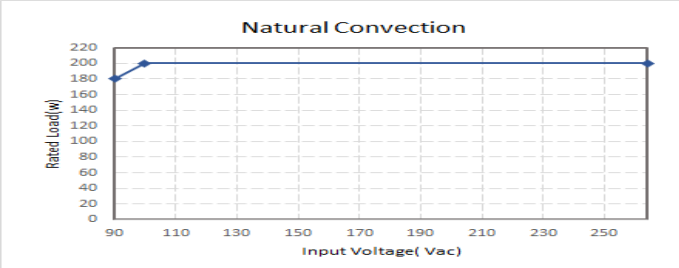
CFM200MXXX Series Derating Curve

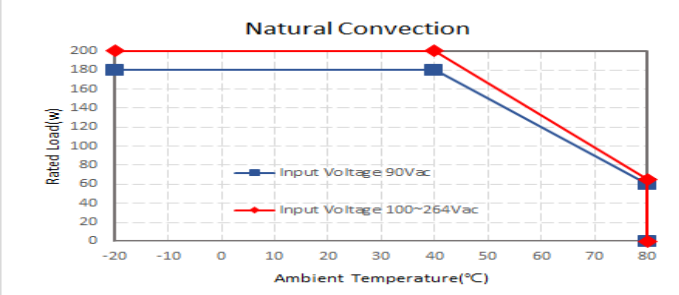


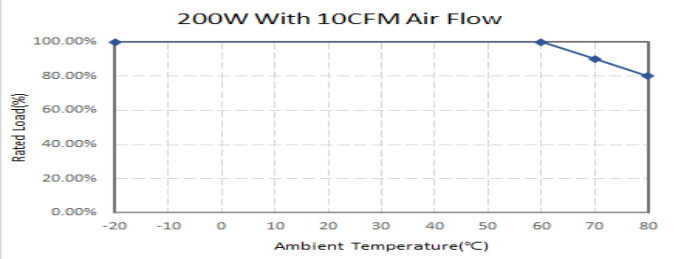




CFM200MXXXC Series Derating Curve







7.2 Test Set-Up

The basic test set-up to measure parameters such as efficiency and load regulation is shown in Figure 1. When testing the Cincon's CFM200M series under any transient conditions, please ensure that the transient response of the source is sufficient to power the equipment under test. We can calculate the

- Efficiency
- Load regulation and line regulation.

The value of efficiency is defined as:

$$\eta = \frac{Vo \times Io}{Pin} \times 100\%$$

Where:

Vo is output voltage

Io is output current

Pin is input power

The value of load regulation is defined as:

$$Load\ reg. = \frac{V_{FL} - V_{NL}}{V_{NL}} \times 100\%$$

Where:

V_{FL} is the output voltage at full load

V_{NL} is the output voltage at 10% load

The value of line regulation is defined as:

$$Line\ reg. = \frac{V_{HL} - V_{LL}}{V_{LL}} \times 100\%$$

Where:

V_{HL} is the output voltage of maximum input voltage at full load.

V_{LL} is the output voltage of minimum input voltage at full load.

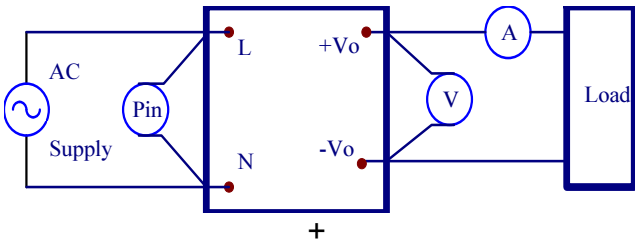


Figure 1. CFM200M Series Test Setup

7.3 Output Ripple and Noise Measurement

The test set-up for noise and ripple measurements is shown in Figure 2. Measured method:
Add a 0.1uF ceramic capacitor and a 47uF electrolytic capacitor to output at 20 MHz Band Width.

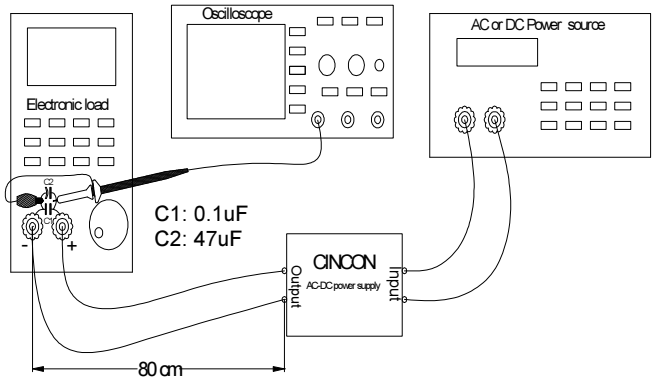
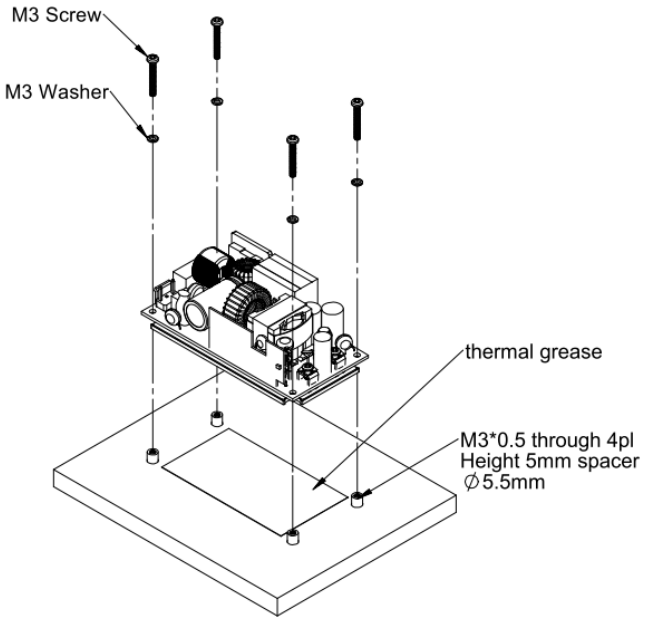


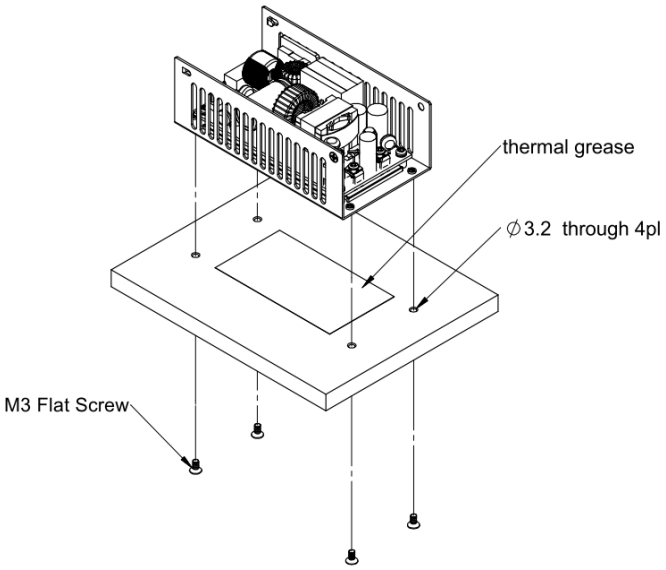
Figure 2. Output Voltage Ripple and Noise Measurement Set-Up

7.4 Installation Instruction

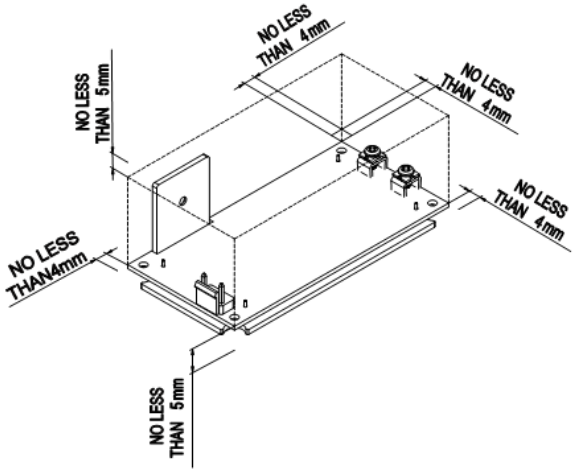
The CFM200M series has four 3.2mm diameter mounting holes. There are two type installations for CFM200M. Please use the mounting holes as follows:
Insert the spacer (5.5mm diameter max.) of 5mm height or more to mount the unit. The vibration specification applies when the unit is mounted on 8mm spacers



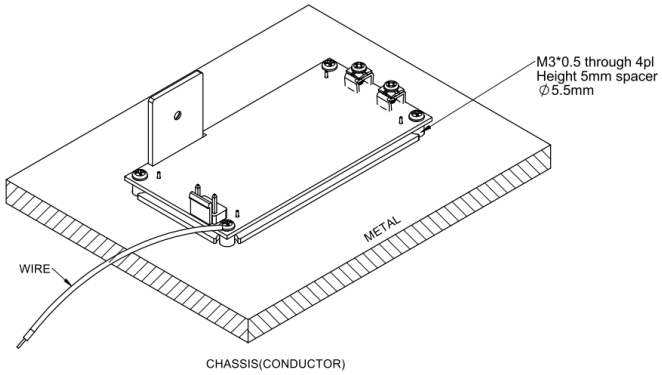
Note: M3 screw head and washer diameter shall not exceed 6mm.



Please allow 4mm side clearance from the components and all side of the PCB. Allow 5mm clearance above the highest parts on the PCB. Be especially careful to allow 5mm between the solder side of the PCB and the mounting surface. If the clearances are not sufficient, the specifications for isolation and withstand will not be valid.



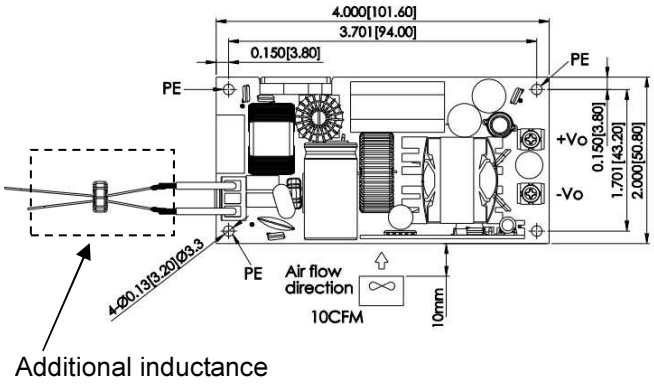
FG should be connected to the earth (ground) terminal of the apparatus. If not, the conducted noise and output noise will increase.



7.5 EMI Test

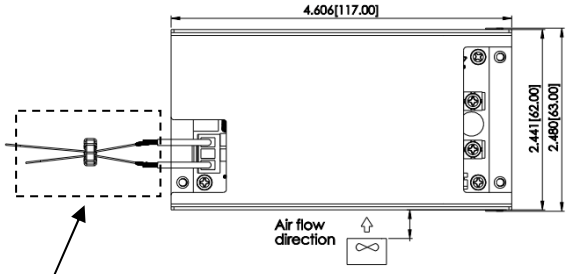
The CFM200M series need additional inductance to meet EN55011 CLASS B when test condition is Class II. If customers use in Class I systems, please ignore this section.

CFM200MXXX



Additional inductance

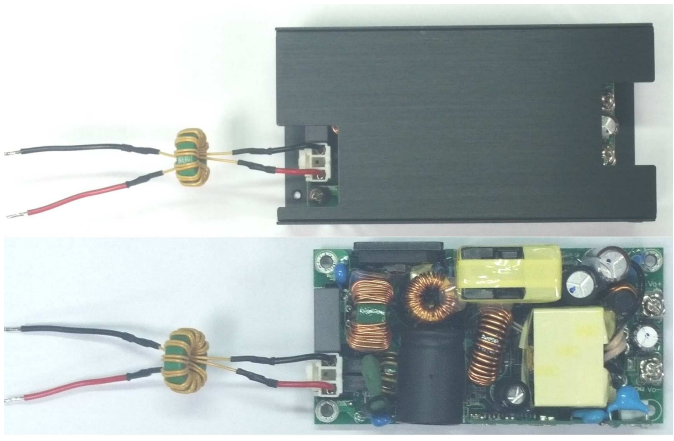
CFM200MXXXC



Additional inductance

Additional Inductance related parameters **:**

specification	Inductance	Duplex Winding /turns	Manufacturers
T16*10*5C R12	1mH	TEX-E Φ0.65/11T	VAKOS



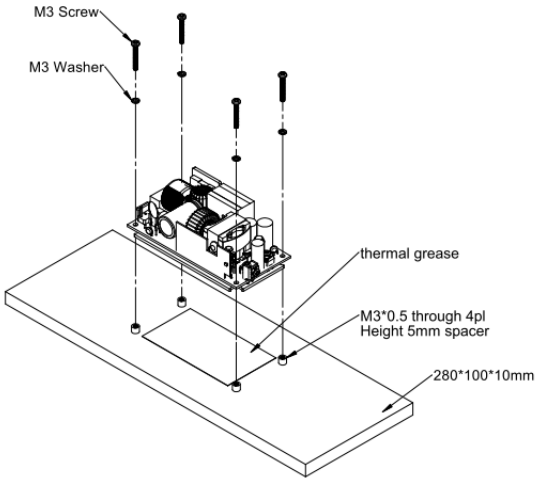
Picture for reference purposes only.

7.6 External *baseplate cooling*

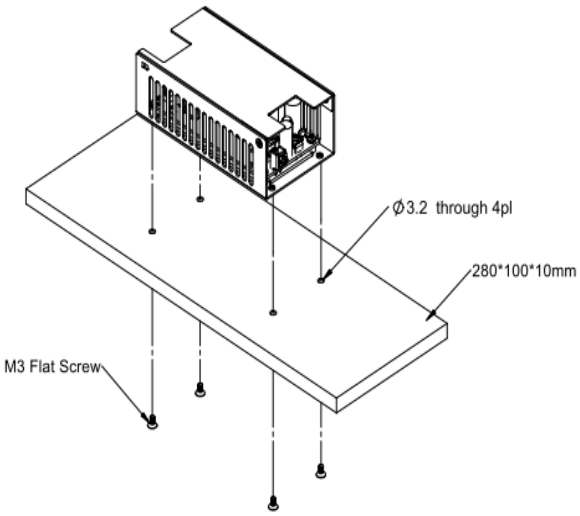
The CFM200M series provide the baseplate cooling for customer to increasing heat dissipation. For example, adding a 280mm*100mm*10mm heatsink at the bottom of CFM200M, between the heatsink and CFM200M with thermal grease to help heating ability.

Please refer to the following figure for installation. When the CFM200M uses an external baseplate cooling solution, it can be used at 200W at 40 degrees C , While the CFM200MXXXC can be used for higher operating temperatures (50℃). Provide you with the installation diagram and temperature curve of this section.

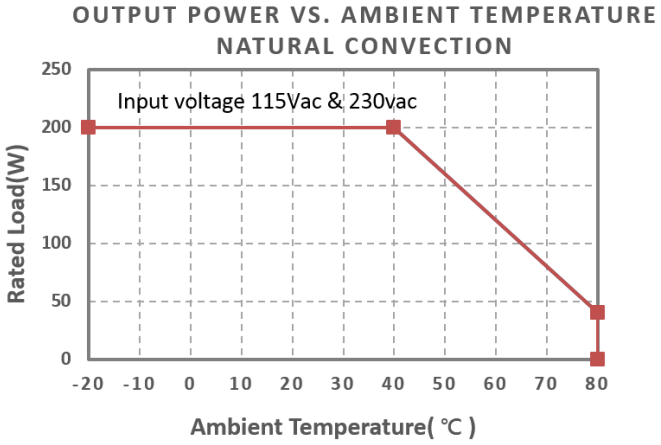
CFM200MXXX installation diagram



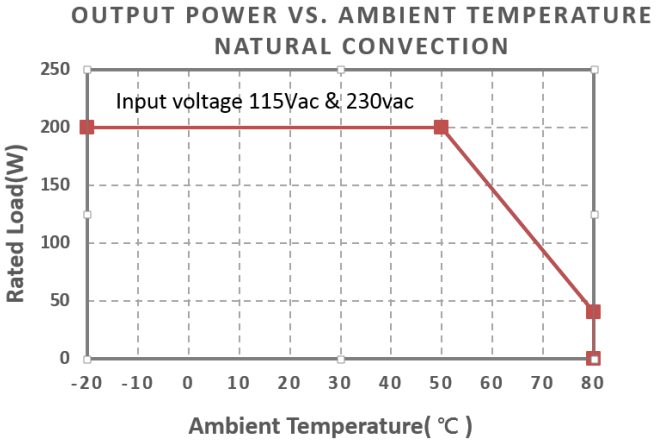
CFM200MXXXC installation diagram



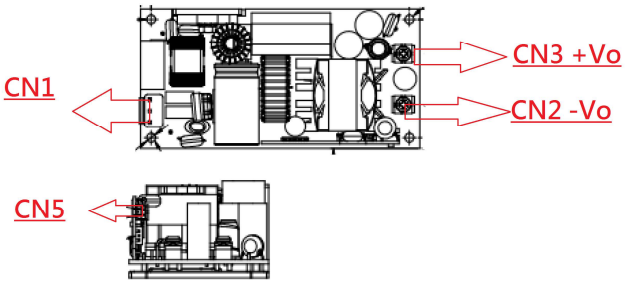
CFM200MXXX with external baseplate cooling



CFM200MXXXC with external baseplate cooling



7.7 Mating Connectors



AC Input (CN1)	Wafer: TAIWAN KING PIN TERMINAL PVHI series or equivalent. Housing: JST VHR series or equivalent.
DC Output (CN2,3)	M3 screw mate with round terminal. (Note: Round terminal of the max outer diameter is 6.75mm, max inner diameter is 3.9mm.)
Fan Output (CN5)	Wafer: TOWNES ENTERPRISE 2001BW series or equivalent. Housing: JST PHR series and JST SPH series crimp terminal or equivalent.

8. Part Number

CFM 200 M XXX C

- C: With Case
- M: Medical
- 120: Output Voltage 12 VDC
  240: Output Voltage 24 VDC
  480: Output Voltage 48 VDC
- 200: Supply Max. Power
- CFM SERIES

9. CFM200M Series Mechanical Outline Diagrams

9.1. Mechanical Outline Diagrams

All Dimensions In Inches(mm)
Tolerance Inches:x,xxx=±0.02
Millimeters:x,xx=±0.5

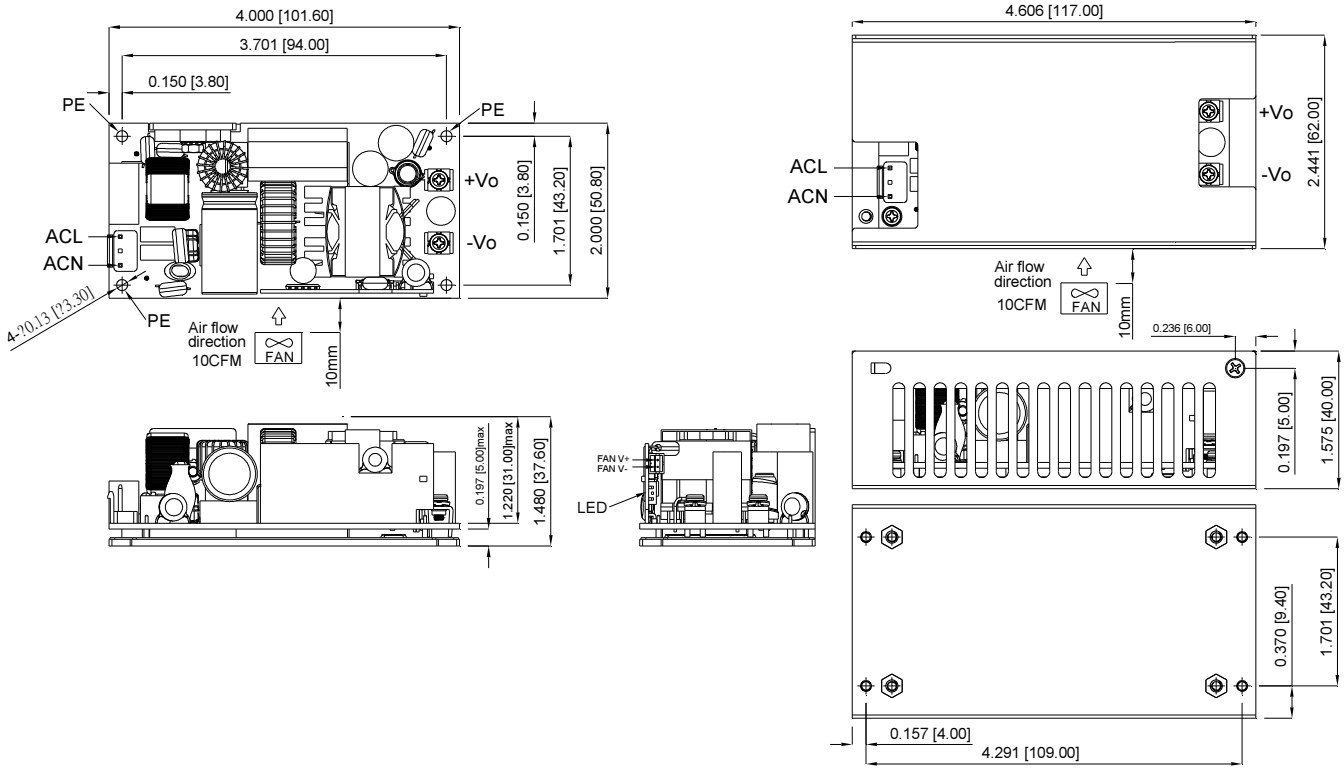
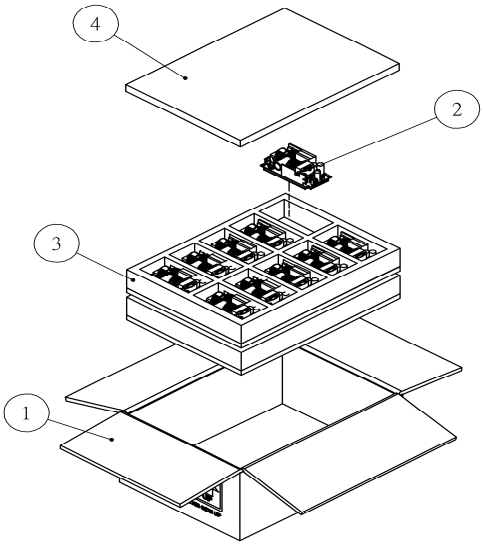


Figure 3. CFM200M series Mechanical Outline Diagram

9.2. Packing Information

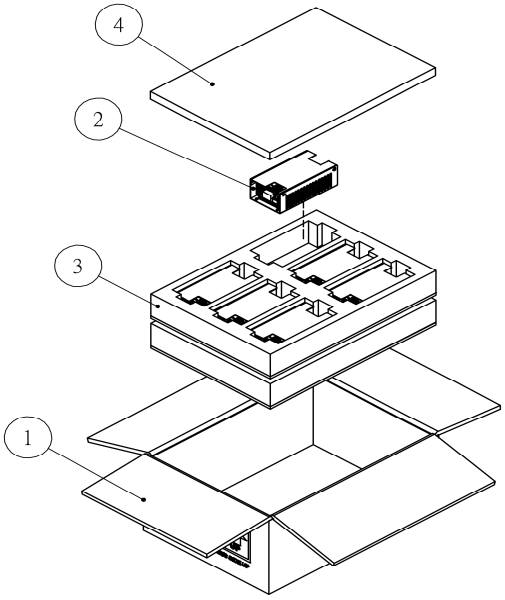
The packing information for CFM200M SERIES is showing as follows:



ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	G64112339	外箱59	119*85*49台分	1
2		CFM200M OPEN成品	101.6*50.8*36.6mm	20
3	G64301170	抗靜電泡棉A	340*245*50mm	2
4	G64308319	抗靜電泡棉	340*245*15mm	1

CFM200M OPEN裝20PCS，含包材總重量約6kg

CFM200M 20Pcs a box, including the total weight of package material about 6Kg



ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	G64112339	外箱 59	119*85*49台分	1
2		CFM200M 成品	117*63*40mm	12
3	G64301171	抗靜電泡棉B	340*245*50mm	2
4	G64308319	抗靜電泡棉	340*245*15mm	1

CFM200M 裝12PCS，含包材總重量約5kg

CFM200MXXXC 12Pcs a box, including the total weight of package material about 5Kg

CINCON ELECTRONICS CO., LTD.

Headquarters:

14F, No.306, Sec.4, Hsin Yi Rd.
Taipei, Taiwan
Tel: 886-2-27086210
Fax: 886-2-27029852
E-mail:
support@cincon.com.tw
Web Site:
http://www.cincon.com

Factory:

No. 8-1, Fu Kung Rd.
Fu Hsing Industrial Park
Fu Hsing Hsiang,
Chang Hua Hsien, Taiwan
Tel: 886-4-7690261
Fax: 886-4-7698031

Cincon North America:

1655 Mesa Verde Ave. Ste 180
Ventura, CA 93003
Tel: 805-639-3350
Fax: 805-639-4101
E-mail: info@cincon.com