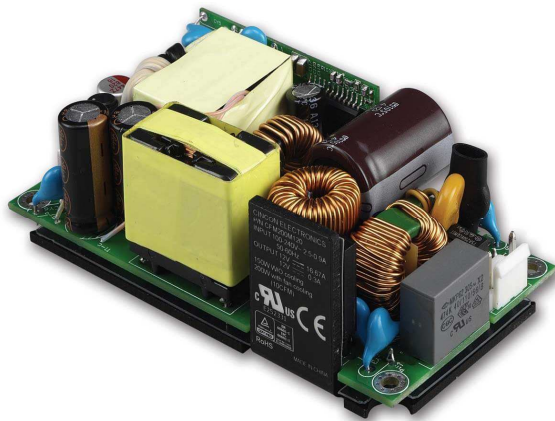




CFM200M Series

Application Note V15

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



Approved By:

| Department | Approved By | Checked By | Written By |
|-------------------------------------|-------------|------------|------------|
| Research and Development Department | Ovid | Wei-Cheng | Horard |
| Design Quality Department | Benny | JoJo | |



CFM200M Series

Application Note V15

Content

| | |
|--|-----------|
| 1. INTRODUCTION | 3 |
| 2. FEATURES | 3 |
| 3. ELECTRICAL BLOCK DIAGRAM | 3 |
| 4. TECHNICAL SPECIFICATIONS | 4 |
| 5. MAIN FEATURES AND FUNCTIONS | 6 |
| 5.1 <i>Operating Temperature Range</i> | 6 |
| 5.2 <i>Output Protection (Over Current Protection)</i> | 6 |
| 6. EMC & SAFETY | 6 |
| 7. APPLICATIONS | 6 |
| 7.1 <i>Power De-Rating Curve</i> | 6 |
| 7.2 <i>Test Set-Up</i> | 7 |
| 7.3 <i>Output Ripple and Noise Measurement</i> | 7 |
| 7.4 <i>Installation Instruction</i> | 7 |
| 7.5 <i>EMI Test</i> | 8 |
| 7.6 <i>External Baseplate Cooling</i> | 9 |
| 7.7 <i>Mating Connectors</i> | 9 |
| 8. PART NUMBER | 10 |
| 9. CFM200M SERIES MECHANICAL OUTLINE DIAGRAMS | 10 |
| 9.1 <i>Mechanical Outline Diagrams</i> | 10 |
| 9.2 <i>Packing Information</i> | 11 |



CFM200M Series

Application Note V15

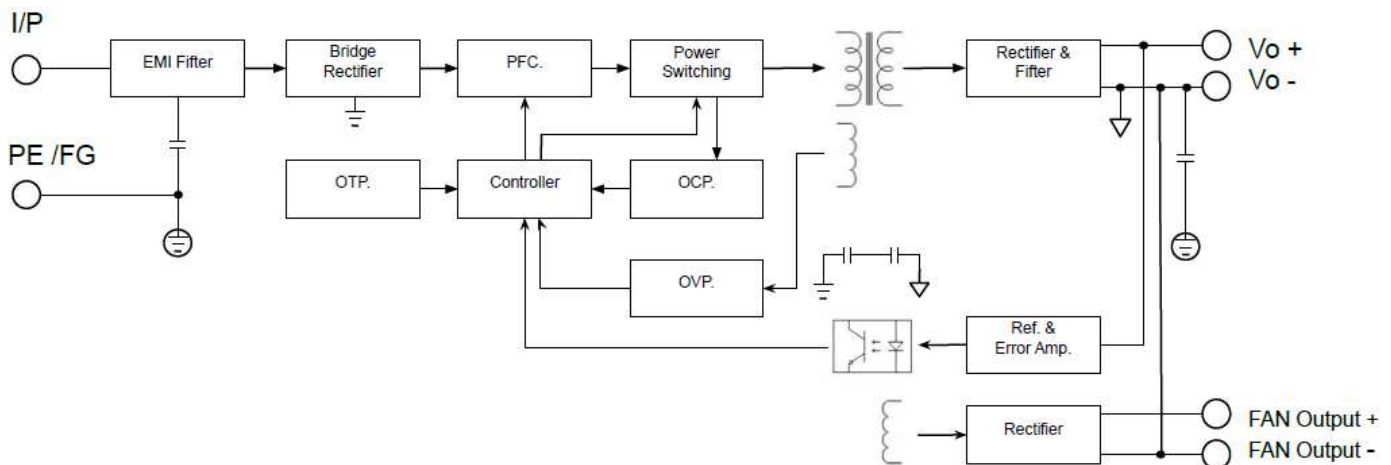
1. Introduction

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
- Active PFC Meets EN61000-3-2
- No Load Input Power Consumption < 0.3W
- High Power Density Up to 16.9W/Inch³/CFM200M
- 12V Fan Output
- High Efficiency up to 93.5% Typical
- IEC/EN/UL 60601-1 2MOPP Approval
- Meet Class II & Class I

3. Electrical Block Diagram





CFM200M Series

Application Note V15

4. Technical Specifications

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

ABSOLUTE MAXIMUM RATINGS

| PARAMETER | NOTES and CONDITIONS | Device | Min. | Typical | Max. | Units |
|--------------------------------|----------------------|--------|------|---------|------|-----------------|
| Input Voltage | | All | 90 | | 264 | V _{ac} |
| | | All | 120 | | 370 | V _{dc} |
| Operating Temperature | See derating curve | All | -20 | | +60 | °C |
| Storage Temperature | | All | -40 | | +85 | °C |
| Input/Output Isolation Voltage | 1 minute | All | 4000 | | | V _{ac} |

INPUT CHARACTERISTICS

| PARAMETER | NOTES and CONDITIONS | Device | Min. | Typical | Max. | Units |
|--------------------------|--|-------------|------|---------|------|-----------------|
| Operating Voltage Range | | All | 100 | | 240 | V _{ac} |
| Input Frequency Range | | All | 47 | | 63 | Hz |
| Maximum Input Current | 100% Load, V _{in} =100V _{ac} | 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 | V _{in} =Nominal V _{in} , I _o =I _o .max, T _c =25°C | CFM200M120/120C | 11.76 | 12 | 12.24 | V _{dc} |
| | | CFM200M240/240C | 23.52 | 24 | 24.48 | |
| | | CFM200M480/480C | 47.04 | 48 | 48.96 | |
| Operating Output Current Range | | CFM200M120/120C | | | 16.67 | A |
| | | CFM200M240/240C | | | 8.33 | |
| | | CFM200M480/480C | | | 4.17 | |
| Holdup Time | V _{in} =115V _{ac} | All | | 10 | | ms |
| Output Voltage Regulation | | | | | | |
| Load Regulation | 20% load to full load | All | | | ±1.0 | % |
| Line Regulation | V _{in} =high line to low line | All | | | ±0.5 | % |
| Over Current Protection | | All | 130 | 150 | 180 | % |
| Over Voltage Protection | | CFM200M120/120C | | 16 | | V _{dc} |
| | | CFM200M240/240C | | 31 | | |
| | | CFM200M480/480C | | 56 | | |
| Output Ripple and Noise | 1. Add a 0.1uF ceramic capacitor and a 47uF aluminum electrolytic capacitor to output 2. Oscilloscope is 20MHz band width 3. Ambient temperature=25°C | CFM200M120/120C | | | 150 | mVp-p |
| | | CFM200M240/240C | | | 240 | |
| | | CFM200M480/480C | | | 480 | |
| Load Capacitance | 1. V _{in} =115V _{ac} and 230V _{ac} 2. Output is 100% full load 3. Ambient temperature=25°C | CFM200M120/120C | | | 16400 | uF |
| | | CFM200M240/240C | | | 8570 | |
| | | CFM200M480/480C | | | 1270 | |



CFM200M Series

Application Note V15

| PARAMETER | NOTES and CONDITIONS | Device | Min. | Typical | Max. | Units |
|------------|---|-----------------|------|---------|------|-------|
| Efficiency | 1. $V_{in}=230V_{ac}$ 2. Output is 100% full load 3. Ambient temperature=25°C | CFM200M120/120C | | 92 | | % |
| | | CFM200M240/240C | | 93.5 | | |
| | | CFM200M480/480C | | 93 | | |

ISOLATION CHARACTERISTICS

| PARAMETER | NOTES and CONDITIONS | Device | Min. | Typical | Max. | Units |
|--------------------------|---|--------|------|---------|------|----------|
| Input to Output | 1 minute (without dielectric breakdown) | All | | | 4000 | V_{ac} |
| Input to Earth (Ground) | 1 minute (without dielectric breakdown) | All | | | 1500 | V_{ac} |
| Output to Earth (Ground) | 1 minute (without dielectric breakdown) | All | | | 1500 | V_{ac} |
| 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 | $I_o=100\%$; $T_a=25^\circ\text{C}$ 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, 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 61000-4-3:2020 | | | | Criteria A | |
| Electrical Fast Transient (EFT) | IEC 61000-4-4:2012, $\pm 0.5\text{kV}$, $\pm 1\text{kV}$, $\pm 2\text{kV}$ | | | | Criteria A | |
| Surge | IEC 61000-4-5:2014+A1:2017, L-N: $\pm 0.5\text{kV}$, $\pm 1\text{kV}$, L-PE, N-PE: $\pm 0.5\text{kV}$, $\pm 1\text{kV}$, $\pm 2\text{kV}$ | | | | 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+A1:2017, Dip: 30% 500ms, Dip: 60% 100ms, Dip >95% 10ms | | | | Criteria A | |
| Voltage Interruptions | IEC 61000-4-11:2004+A1:2017, >95% 5000ms | | | | Criteria B | |
| Voltage Interruptions | IEC 61000-4-11:2004+A1:2017, >95% 5000ms | | | | | |



CFM200M Series

Application Note V15

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°C to 60°C. 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

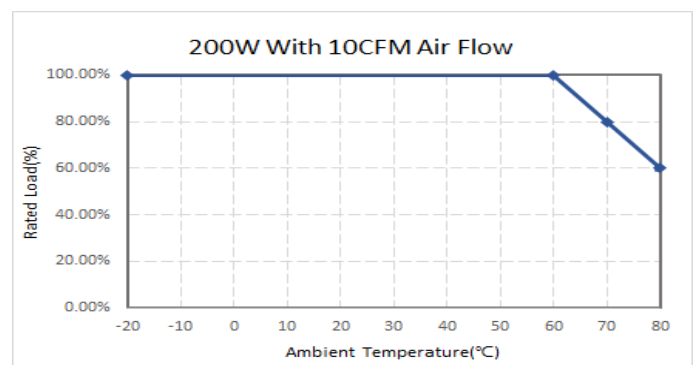
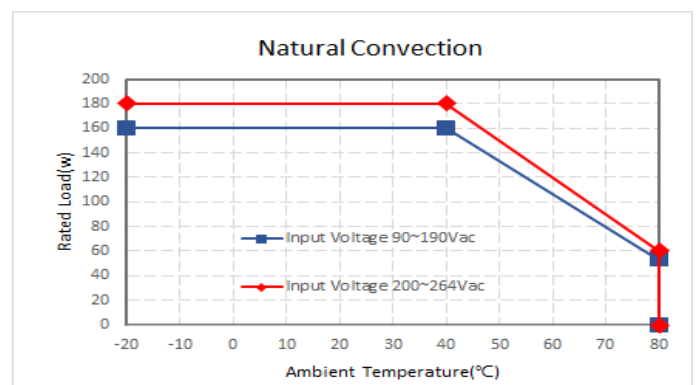
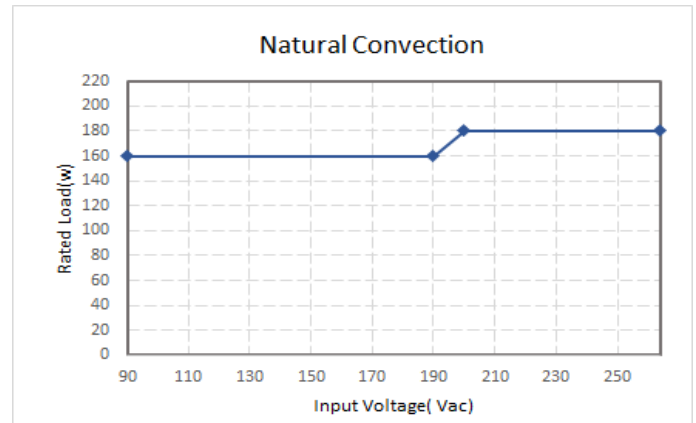
■ Safety (Ed. 3.1)

Class I & Class II, IEC60601-1:2005+A1:2012
EN60601-1:2006+A11:2011+A1+A12
UL ANS/AAMI ES60601-1

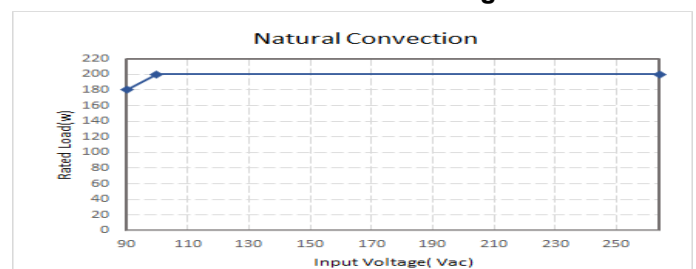
7. Applications

7.1 Power De-Rating Curve

CFM200MXXX Series Derating Curve



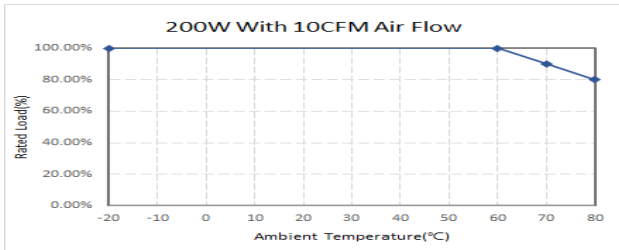
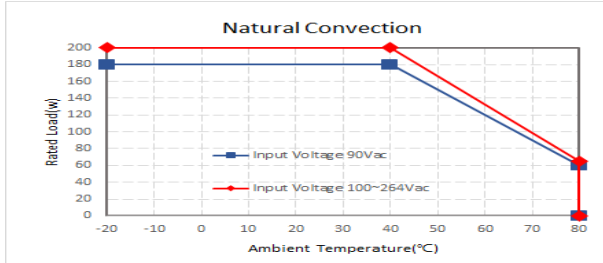
CFM200MXXXC Series Derating Curve





CFM200M Series

Application Note V15



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:

$$\eta = \frac{V_o \times I_o}{P_{in}} \times 100\%$$

Where:

V_o is output voltage

I_o is output current

P_{in} is input power

The value of load regulation is defined as:

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

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:

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

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.

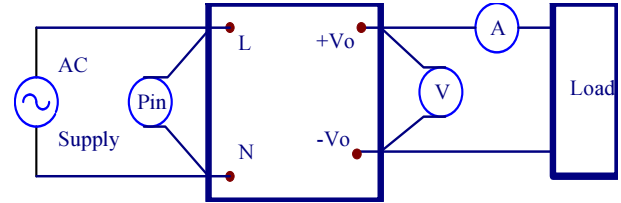


Figure 1. CFM200M Series Test Setup

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.

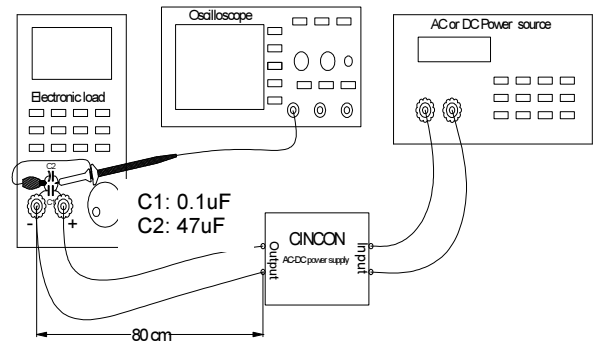
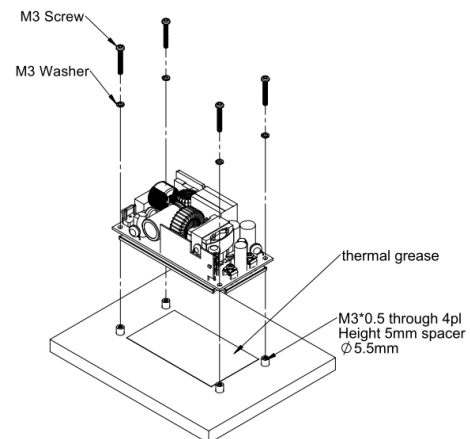


Figure 2. Output Voltage Ripple and Noise Measurement Set-Up

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.

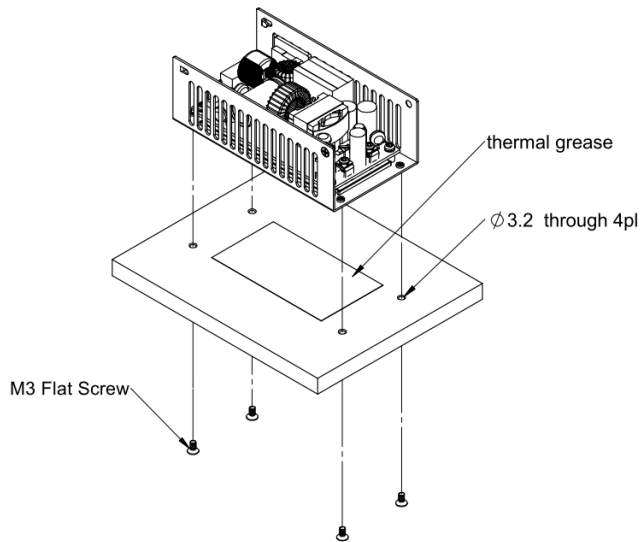


Note: M3 screw head and washer diameter shall not exceed 6mm.

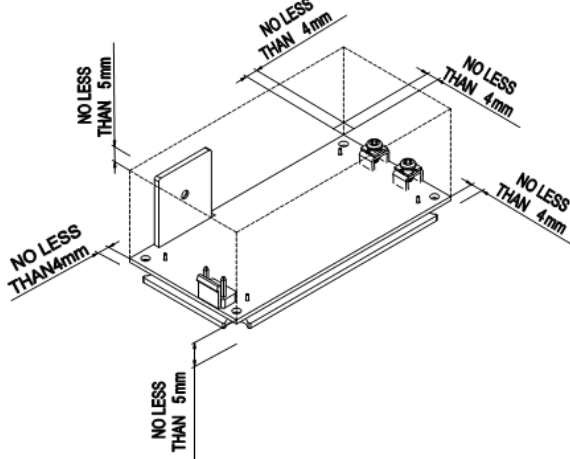


CFM200M Series

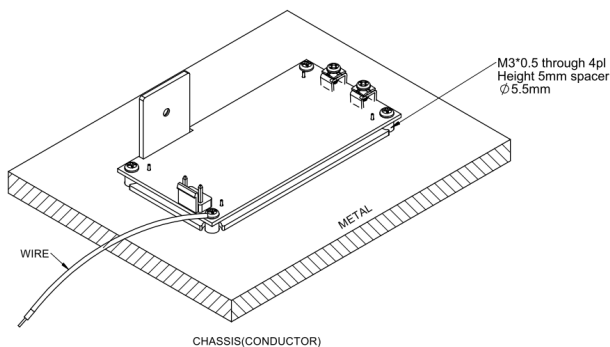
Application Note V15



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.



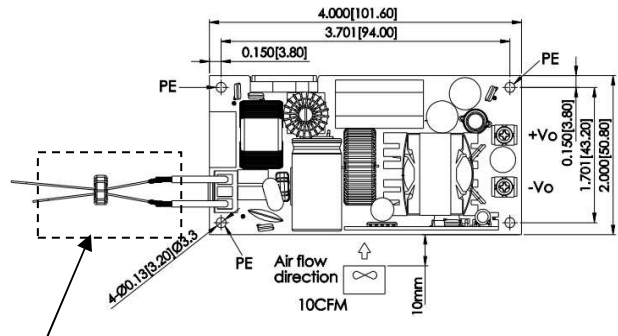
FG should be connected to the earth (ground) terminal of the apparatus. If not, the conducted noise and output noise will increase.



7.5 EMI Test

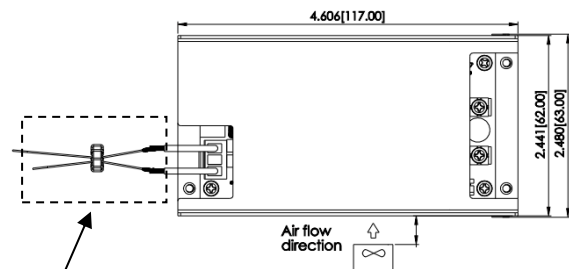
The CFM200M series need additional inductance to meet EN55011 Class B when test condition is Class II. If customers use in Class I systems, please ignore this section.

CFM200MXXX



Additional

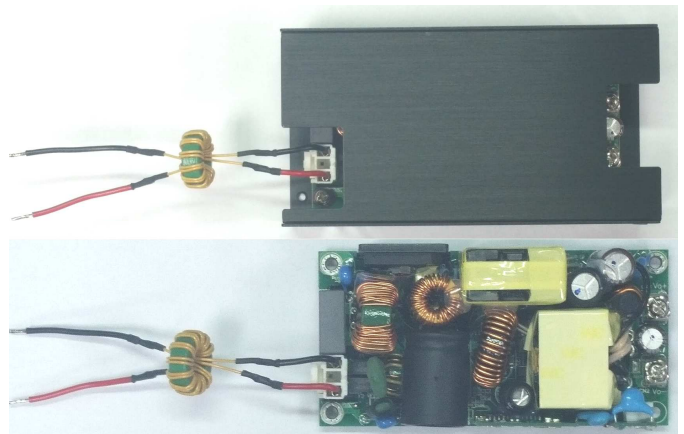
CFM200MXXXC



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.



CFM200M Series

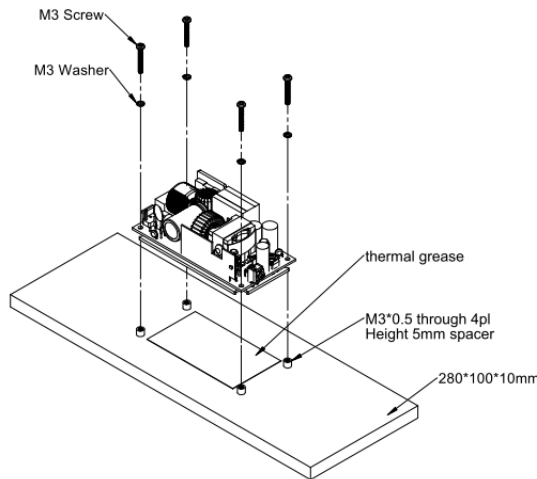
Application Note V15

7.6 External Baseplate Cooling

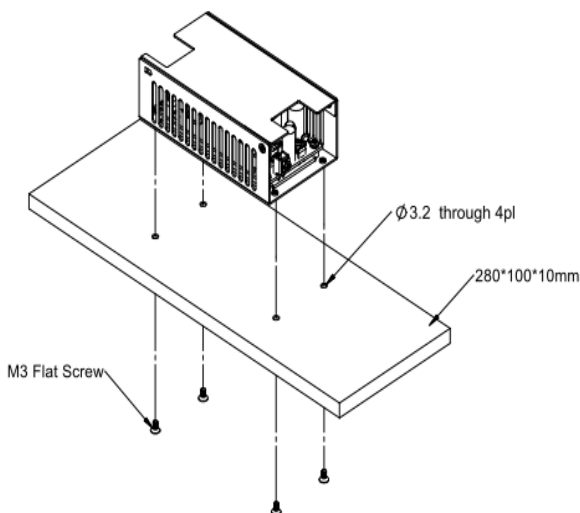
The CFM200M series provide the baseplate cooling for customer to increasing heat dissipation. For example, adding a 280mm*100mm*10mm heatsink at the bottom of CFM200M, between the heatsink and CFM200M with thermal grease to help heating ability.

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°C). Provide you with the installation diagram and temperature curve of this section.

CFM200MXXX installation diagram

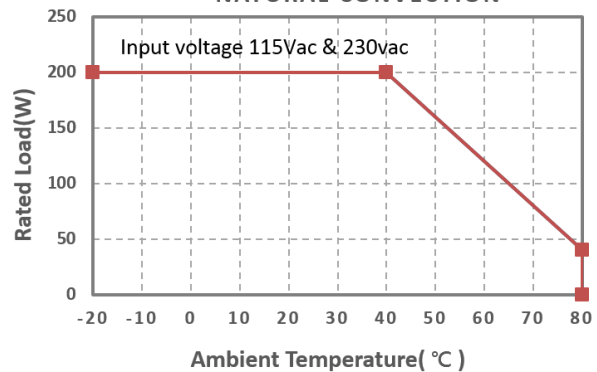


CFM200MXXXC installation diagram



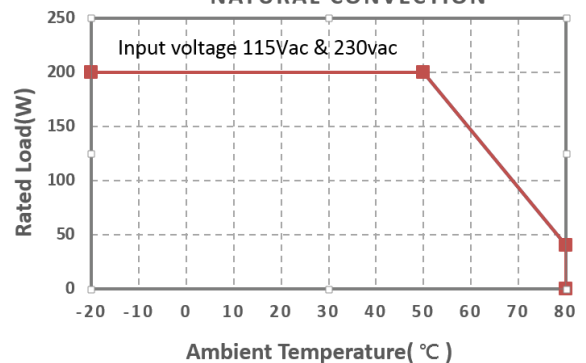
CFM200MXXX with external baseplate cooling

OUTPUT POWER VS. AMBIENT TEMPERATURE
NATURAL CONVECTION

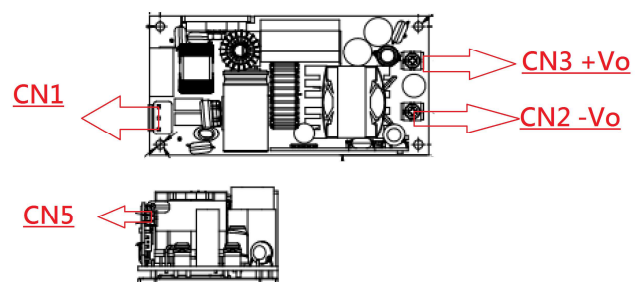


CFM200MXXXC with external baseplate cooling

OUTPUT POWER VS. AMBIENT TEMPERATURE
NATURAL CONVECTION



7.7 Mating Connectors



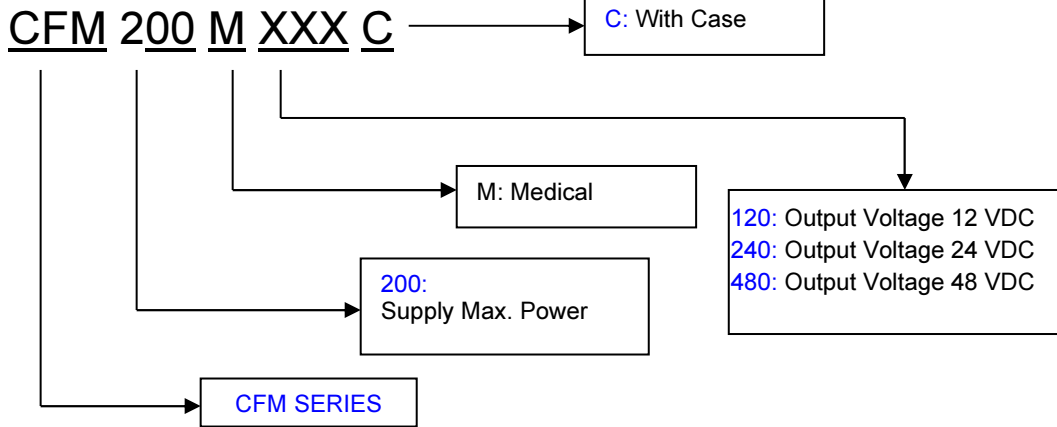
| | |
|-------------------|---|
| AC Input (CN1) | Wafer: TAIWAN KING PIN TERMINAL PVHI series or equivalent. Housing: JST VHR series or equivalent. |
| DC Output (CN2,3) | M3 screw mate with round terminal. (Note: Round terminal of the max outer diameter is 6.75mm, max inner diameter is 3.9mm.) |
|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



CFM200M Series

Application Note V15

8. Part Number



9. CFM200M Series Mechanical Outline Diagrams

9.1 Mechanical Outline Diagrams

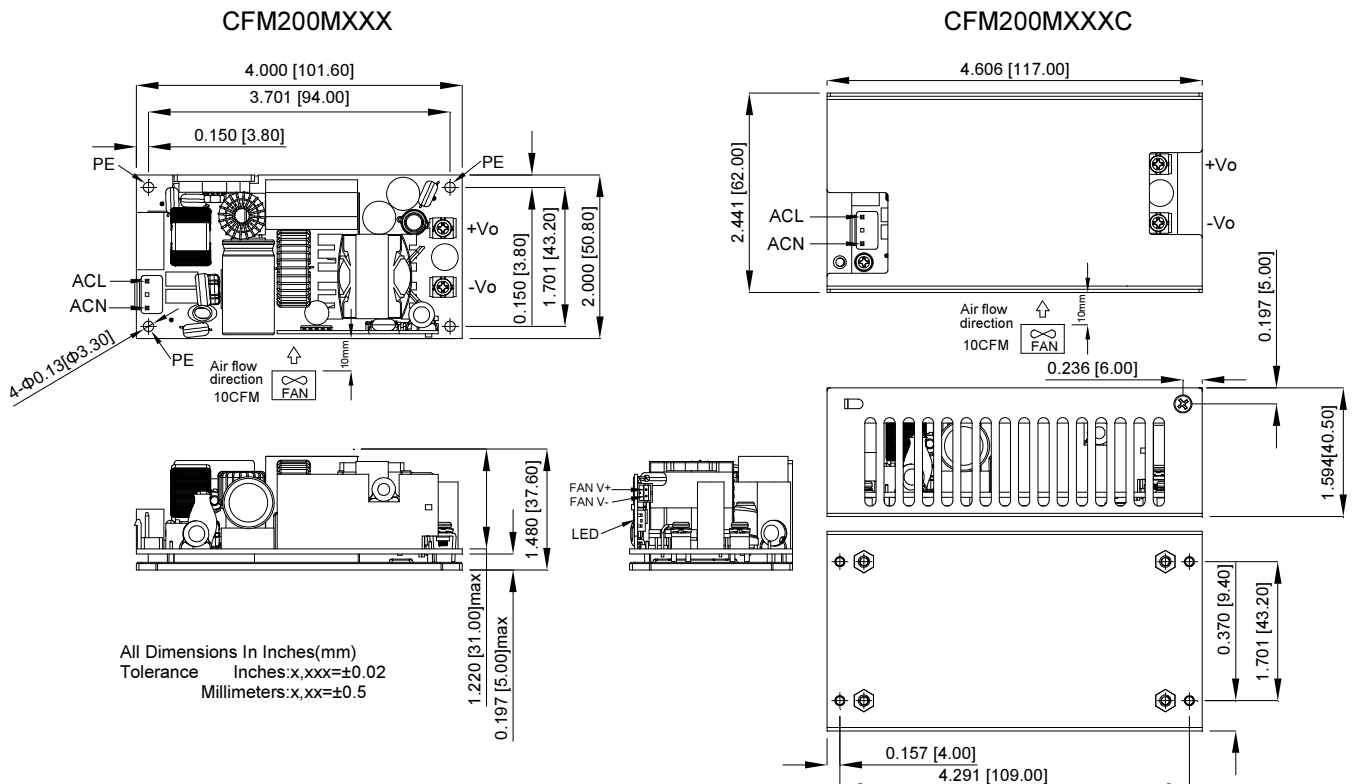


Figure 3. CFM200M series Mechanical Outline Diagram

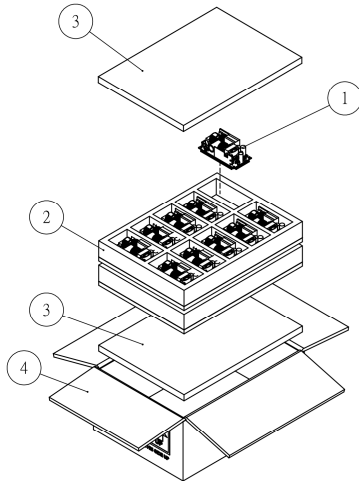


CFM200M Series

Application Note V15

9.2 Packing Information

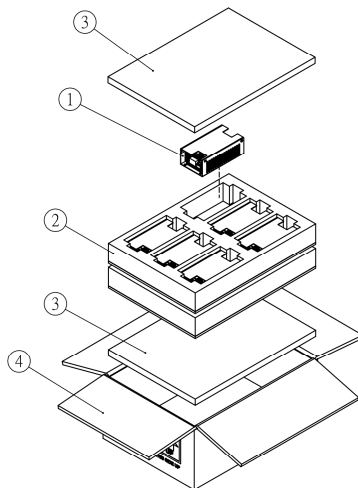
The packing information for CFM200M series is showing as follows:



| ITEM | PART NO. | NAME | OUTSIDE DIM | PCS |
|------|-----------|---------------------|---------------------|-----|
| 1 | - | CFM200MXXX Product | 101.6x50.8x37.6mm | 20 |
| 2 | G64301170 | Antistatic Foam | 340x245x50mm | 2 |
| 3 | G64308319 | Antistatic Foam | 340x245x15mm | 2 |
| 4 | G64112339 | No.59 Cardboard Box | 360.6*257.6*148.5mm | 1 |

Each Box Packaging 20 PCS Products
 Net weight Ref. 5.1 Kg
 Gross weight Ref. 6.1 Kg

CFM200M 20PCS a box, including the total weight of package material about 6.1Kg



| ITEM | PART NO. | NAME | OUTSIDE DIM | PCS |
|------|-----------|---------------------|---------------------|-----|
| 1 | - | CFM200MXXXC Product | 117x62x40.5mm | 12 |
| 2 | G64301171 | Antistatic Foam | 340x245x50mm | 2 |
| 3 | G64308319 | Antistatic Foam | 340x245x15mm | 2 |
| 4 | G64112339 | No.59 Cardboard Box | 360.6x257.6x148.5mm | 1 |

Each Box Packaging 12 PCS Products
 Net weight Ref. 3.8 Kg
 Gross weight Ref. 4.8 Kg

CFM200MXXXC 12PCS a box, including the total weight of package material about 4.8Kg

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