



# CFM300S Series

## Application Note V10 September 2016

### 300W AC-DC Power Supply with PFC CFM300S Series APPLICATION NOTE



#### Approved By:

| Department                          | Approved By | Checked By | Written By |
|-------------------------------------|-------------|------------|------------|
| Research and Development Department | Hunter      | Yang       | Wei-Cheng  |
| Quality Assurance Department        | Jack        | Benny      |            |



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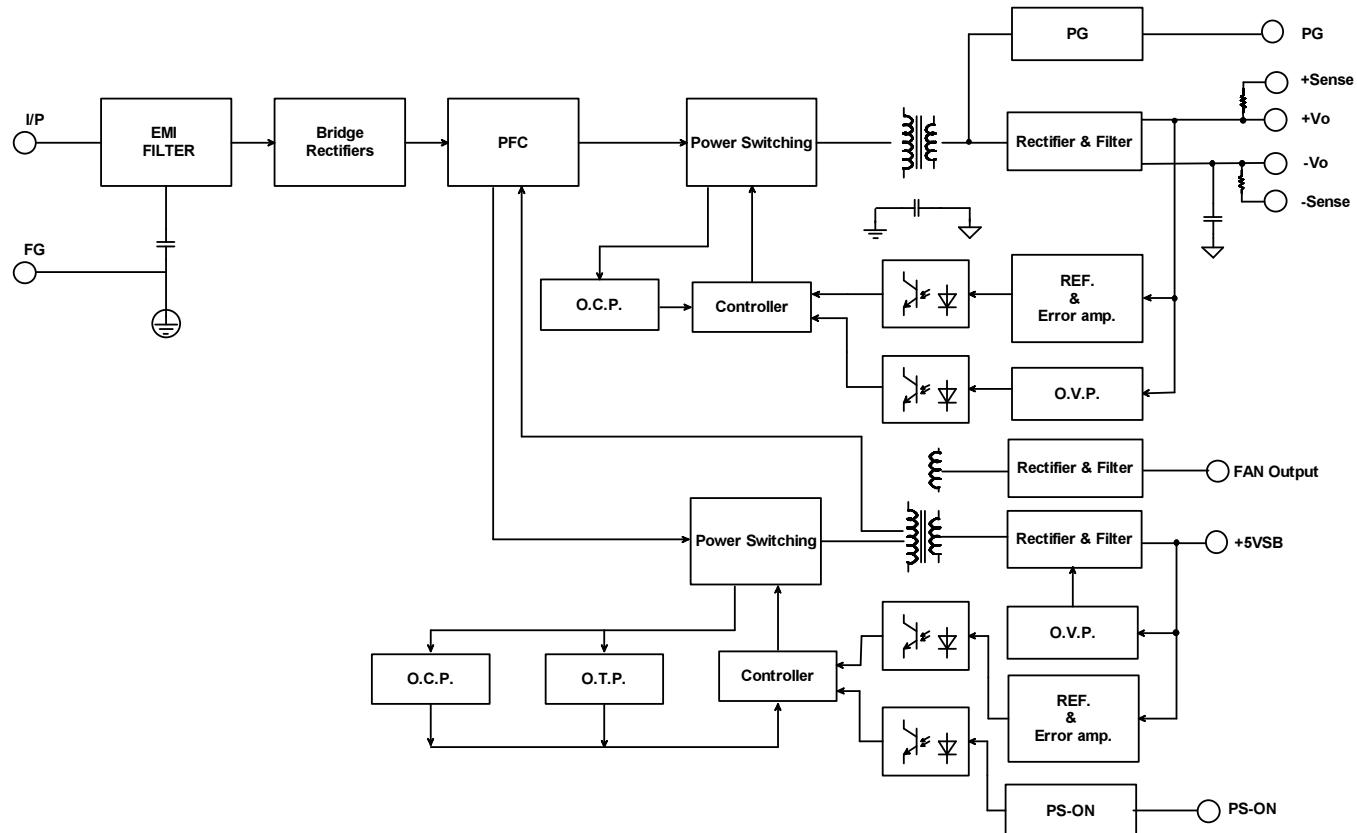
### 1. Introduction

This application note describes the features and functions of Cincon's CFM300S 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 CFM300S series power module is extremely reliable.

### 2. CFM300S Series Converter Features

- Universal Input Range 90~264Vac
- 3"x 5" Compact Size/CFM300S
- 250W with natural convection @ 220Vac/CFM300S
- 300W with natural convection @ 220Vac/CFM300SXXXC
- Meets EN55011 and EN55022 Class B
- Meets 2MOPP
- Active PFC Meets EN61000-3-2
- High Efficiency Up to 94% Typical
- High Power Density Up to 18W/inch<sup>3</sup>
- Remote Voltage Sense
- PS On/Off Remote Control
- +5V Stand-by Output Power
- 12V fan output
- No load power consumption < 0.3W

### 3. Electrical Block Diagram





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### 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 (Continuous)     |                      | All    | 90   |         | 264  | Vac   |
| Operating Temperature          | See derating curve   | All    | -40  |         | +80  | °C    |
| Storage Temperature            |                      | All    | -40  |         | +85  | °C    |
| 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    |      |         | 4    | A     |
| Leakage Current         |                                 | All    |      |         | 3.5  | mA    |
| Inrush Current          | Vin=240Vac, cold start at 25°C. | All    |      |         | 30   | A     |

#### OUTPUT CHARACTERISTICS

| PARAMETER                      | NOTES and CONDITIONS  | Device          | Min. | Typical | Max.  | Units |
|--------------------------------|---|-----------------|------|---------|-------|-------|
| Output Voltage Set Point       | Vin=Nominal Vin, Io=Io .max, Tc=25°C.   | CFM300S120/120C | 11.4 | 12      | 12.6  | Vdc   |
|                                |   | CFM300S240/240C | 22.8 | 24      | 25.2  |       |
|                                |   | CFM300S360/360C | 34.2 | 36      | 37.8  |       |
|                                |   | CFM300S480/480C | 45.6 | 48      | 50.4  |       |
| Operating Output Current Range |   | CFM300S120/120C |      |         | 25    | A     |
|                                |   | CFM300S240/240C |      |         | 12.5  |       |
|                                |   | CFM300S360/360C |      |         | 8.34  |       |
|                                |   | CFM300S480/480C |      |         | 6.25  |       |
| Holdup Time                    | Vin=115Vac  |                 |      | 16      |       | ms    |
| Output Voltage Regulation      |   |                 |      |         |       |       |
| Load Regulation                | 10% load to full load   | All             |      |         | ±1.0  | %     |
| Line Regulation                | Vin=high line to low line   | All             |      |         | ±0.5  | %     |
| Over Current Protection        | Hiccup mode(Auto Recovery)  | All             | 130  | 150     | 180   | %     |
| Over Voltage Protection        | Latch mode  | CFM300S120/120C |      | 15      |       | Vdc   |
|                                |   | CFM300S240/240C |      | 30      |       |       |
|                                |   | CFM300S360/360C |      | 43      |       |       |
|                                |   | CFM300S480/480C |      | 56      |       |       |
| Over Temperature Protection    | The temperature of C37(Auto Recovery)   | All             |      |         | 110   | °C    |
| Output Ripple and Noise        | 1. Add a 0.1uF ceramic capacitor and a 10uF aluminum electrolytic capacitor to output.<br>2. Oscilloscope is 20MHz band width.<br>3. Ambient temperature=25°C | CFM300S120/120C |      |         | 120   | mVp-p |
|                                |   | CFM300S240/240C |      |         | 150   |       |
|                                |   | CFM300S360/360C |      |         | 150   |       |
|                                |   | CFM300S480/480C |      |         | 150   |       |
| Load Capacitance               | 1. Input voltage is 115VAC and 230VAC<br>2. Output is max. load   | CFM300S120/120C |      |         | 25000 | uF    |
|                                |   | CFM300S240/240C |      |         | 12500 |       |
|                                |   | CFM300S360/360C |      |         | 5000  |       |
|                                |   | CFM300S480/480C |      |         | 3750  |       |



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| PARAMETER      | NOTES and CONDITIONS  | Device   | Min. | Typical                      | Max. | Units |
|----------------|---|--|------|------------------------------|------|-------|
| Efficiency     | 1. Input voltage is 230VAC<br>2. Output is max. load  | CFM300S120/120C<br>CFM300S240/240C<br>CFM300S360/360C<br>CFM300S480/480C |      | 92.5<br>93.5<br>93.5<br>94.0 |      | %     |
| PS-On Signal   | PS-On   | All  | 0    |                              | 0.5  | Vdc   |
|                | PS-Off  |  | 2    |                              | 5    |       |
| Power Good(PG) | 1. Input voltage is 90VAC~264VAC<br>2. Output is max. load<br>3. The TTL goes high after power set up             | All  | 50   |                              | 250  | ms    |
| Power Fail(PG) | 1. Input voltage is 90VAC~264VAC<br>2. Output is max. load<br>3. The TTL goes low before Vo below 90% rated value | All  | 5    |                              | 20   | ms    |

### ISOLATION CHARACTERISTICS

| PARAMETER            | NOTES and CONDITIONS | Device | Min. | Typical | Max. | Units |
|----------------------|----------------------|--------|------|---------|------|-------|
| Input to Output      | 1 minute             | All    |      |         | 3000 | Vac   |
| Input to Earth       | 1 minute             | All    |      |         | 1500 | Vac   |
| Output to Earth      | 1 minute             | All    |      |         | 500  | Vac   |
| Isolation Resistance |                      | All    | 100  |         |      | MΩ    |

### FEATURE CHARACTERISTICS

| PARAMETER                 | NOTES and CONDITIONS  | Device | Min. | Typical | Max. | Units |
|---------------------------|-----------------------|--------|------|---------|------|-------|
| Switching Frequency       |                       | All    |      | 70      |      | KHz   |
| Output Voltage adjustment | Pout=max. rated power | All    | -5   |         | +5   | %     |

### GENERAL SPECIFICATIONS

| PARAMETER  | NOTES and CONDITIONS  | Device                    | Min. | Typical    | Max. | Units   |
|--|---|---------------------------|------|------------|------|---------|
| Humidity   | Non-condensing  | All                       |      |            | 93   | % RH    |
| Shock/Vibration                                  | Meets EN61373, MIL-STD-810F   |                           |      |            |      |         |
| MTBF   | Io=100%; Ta=25°C per MIL-HDBK-217F  | All                       |      | 160        |      | K hours |
| Weight   |   | CFM300SXXX<br>CFM300SXXXC |      | 420<br>550 |      | g       |
| Safety   | Class I, IEC60950-1, EN60950-1, UL60950-1   |                           |      |            |      |         |
| EMC Emission                                     | EN55032, EN55022, EN61000-3-2, EN61000-3-3, FCC CFR 47 Part 15 Subpart B,5        |                           |      |            |      |         |
| Conducted disturbance at main terminal           | EN55032:2012+AC:2013, EN55022:2010+AC2011, Class B, FCC CFR 47 Part 15 Subpart B  |                           |      |            |      |         |
| Radiated disturbance                             | EN55032:2012+AC:2013, EN55022:2010+AC2011, Class B, FCC CFR 47 Part 15 Subpart B  |                           |      |            |      |         |
| Harmonic current emissions                       | IEC 61000-3-2:2014, Class C & D   |                           |      |            |      |         |
| Voltage fluctuations & flicker                   | IEC 61000-3-3:2013  |                           |      |            |      |         |
| EMC Immunity                                     | IEC61000-4-2,3,4,5,6,8,11   |                           |      |            |      |         |
| Electrostatic discharge (ESD)                    | IEC 61000-4-2:2008, ±2kv, ±4kv, Criteria A  |                           |      |            |      |         |
| 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 61000-4-5:2005, 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  |                           |      |            |      |         |



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| PARAMETER             | NOTES and CONDITIONS  | Device | Min. | Typical | Max. | Units |
|-----------------------|---|--------|------|---------|------|-------|
| Voltage dips          | IEC 61000-4-11:2004, Dip: 30% reduction, Dip: 70% reduction, Criteria A |        |      |         |      |       |
| Voltage interruptions | IEC 61000-4-11:2004, >95% reduction, Criteria B                         |        |      |         |      |       |



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### 5. Main Features and Functions

#### 5.1 Operating Temperature Range

The highly efficient design of Cincon's CFM300S series power modules has resulted in their ability to operate within ambient temperature environments from  $-40^{\circ}\text{C}$  to  $80^{\circ}\text{C}$ . 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

EN55032, EN55022, EN61000-3-2, EN61000-3-3, FCC CFR 47 Part 15 Subpart B, IEC61000-4-2, IEC61000-4-3, IEC61000-4-4, IEC61000-4-5, IEC61000-4-6, IEC61000-4-8, IEC61000-4-11

#### ■ Safety

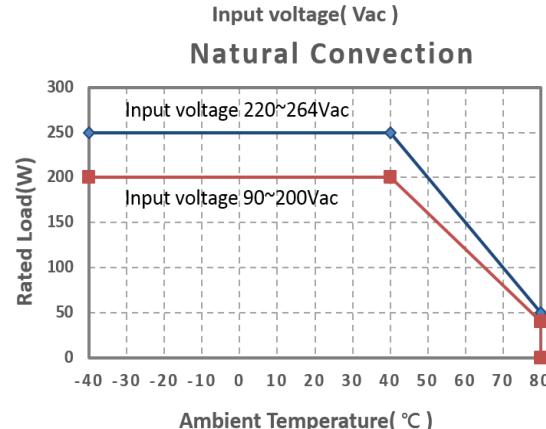
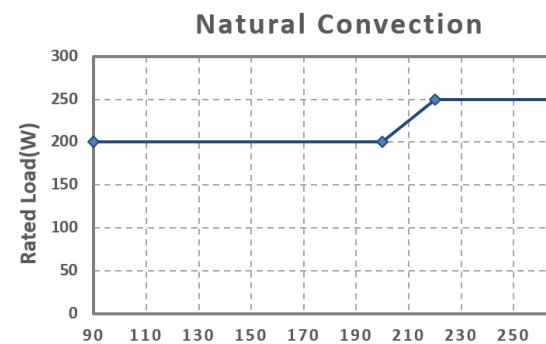
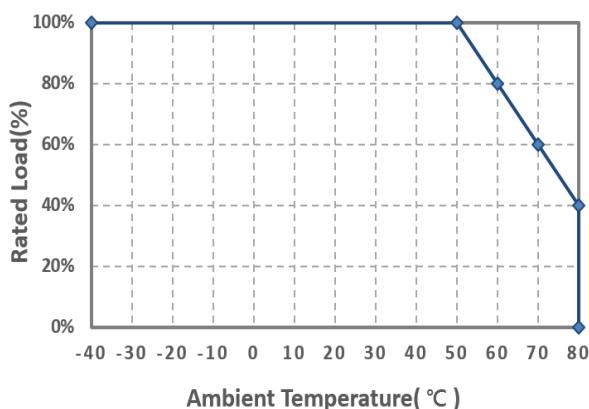
Class I, IEC60950-1, EN60950-1, UL60950-1

### 7. Applications

#### 7.1 Power De-Rating Curve

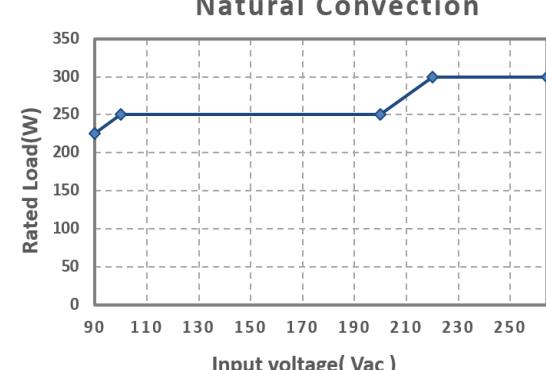
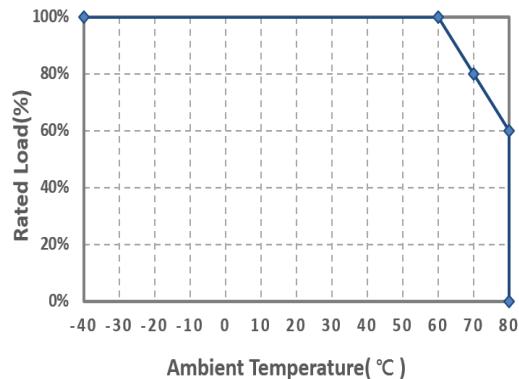
##### CFM300S Series Derating Curve

##### 300W With 10CFM Air Flow



##### CFM300SXXXX Series Derating Curve

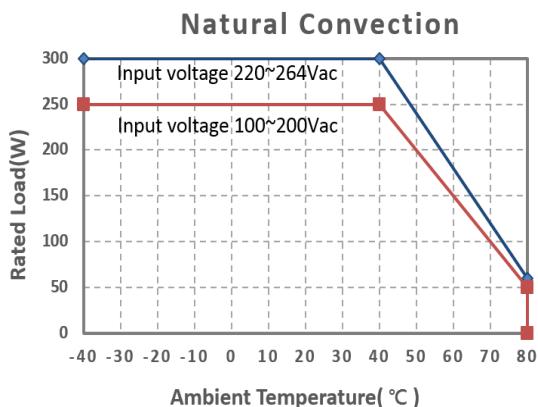
##### 300W With 10CFM Air Flow





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### 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 CFM300S 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.

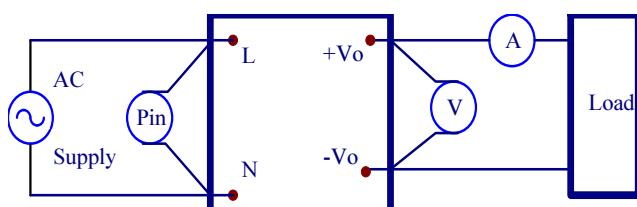


Figure 1. CFM300S Series Test Setup

### 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 10 uF electrolytic capacitor to output at 20 MHz Band Width.

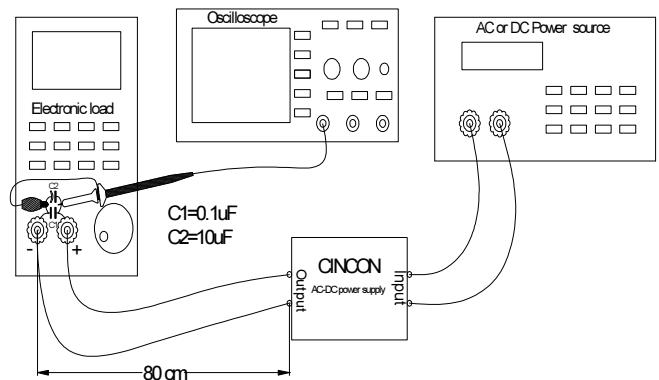
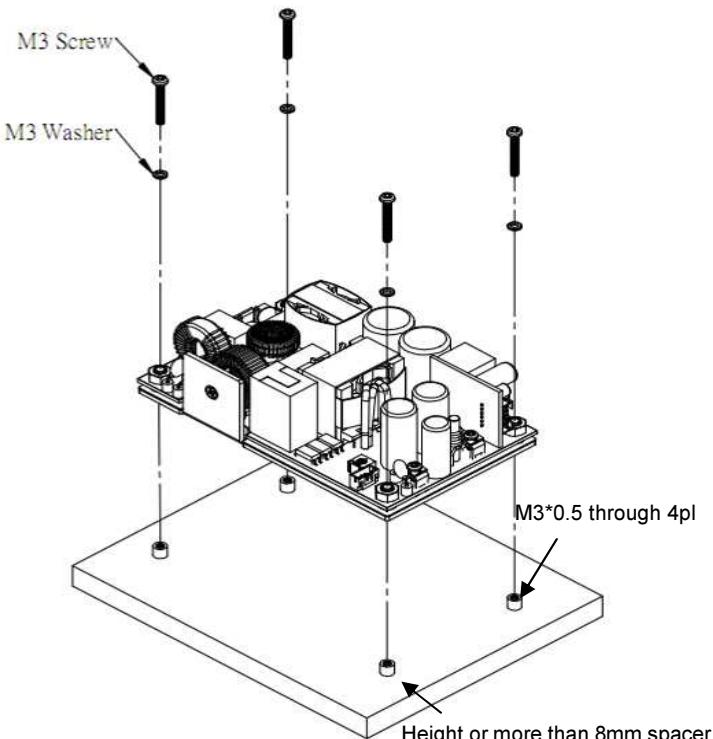


Figure 2. Output Voltage Ripple and Noise Measurement Set-Up

### 7.4 Installation Instruction

The CFM300S series has four 4mm diameter mounting holes. There are three type installations for CFM300S. Please use the mounting holes as follows:

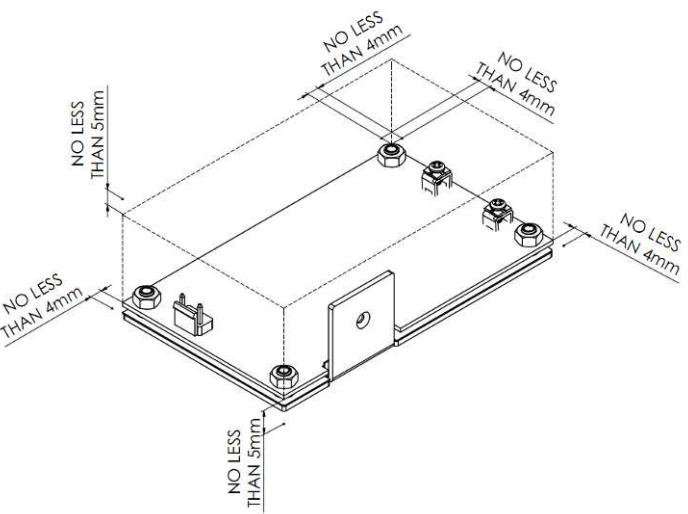
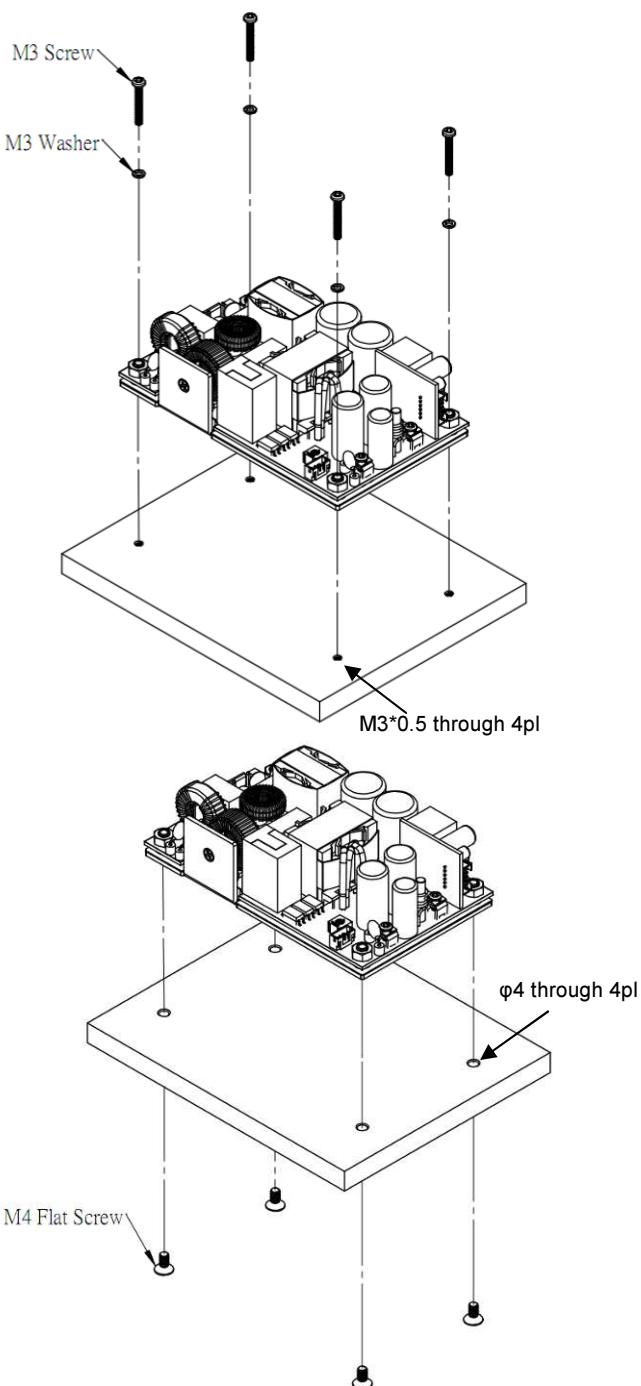
Insert the spacer (4mm diameter max.) of 8mm height or more to mount the unit. The vibration specification applies when the unit is mounted on 8mm spacers



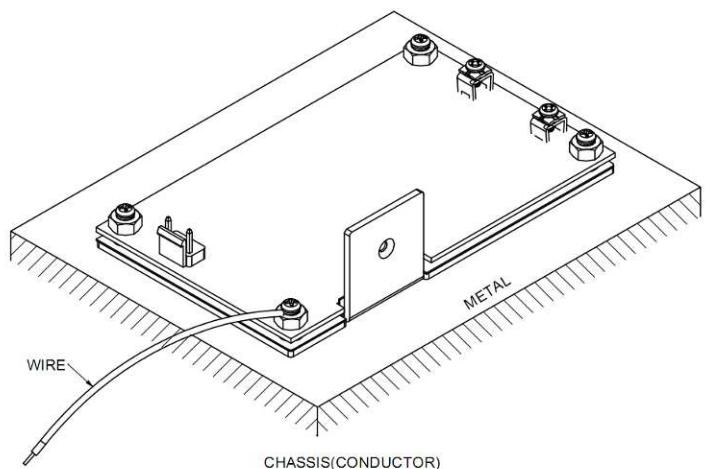


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FG should be connected to the earth (ground) terminal of the apparatus. If not, the conducted noise and output noise will increase.



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 8mm 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.

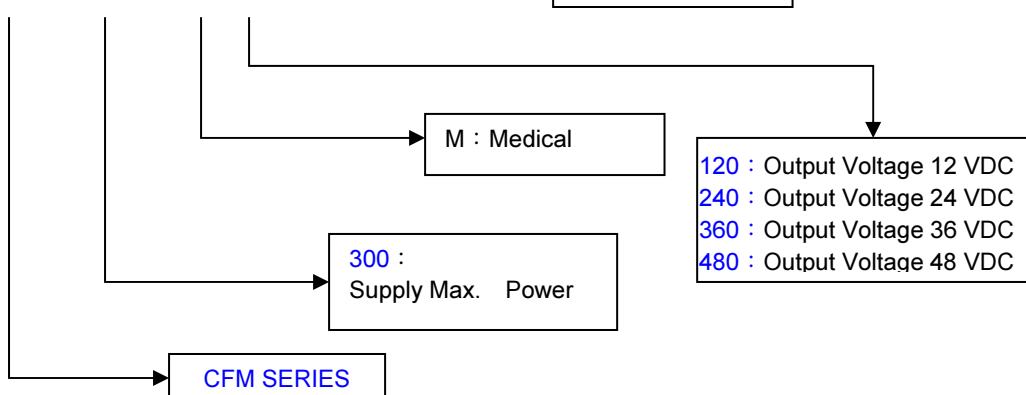


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### 8. Part Number

CFM 300 S XXX C → C : With Case



### 9. CFM300S Series Mechanical Outline Diagrams

All Dimensions in Inches[mm]

Tolerance Inches:x.xxx±0.02

Millimeters:x.xx±0.5

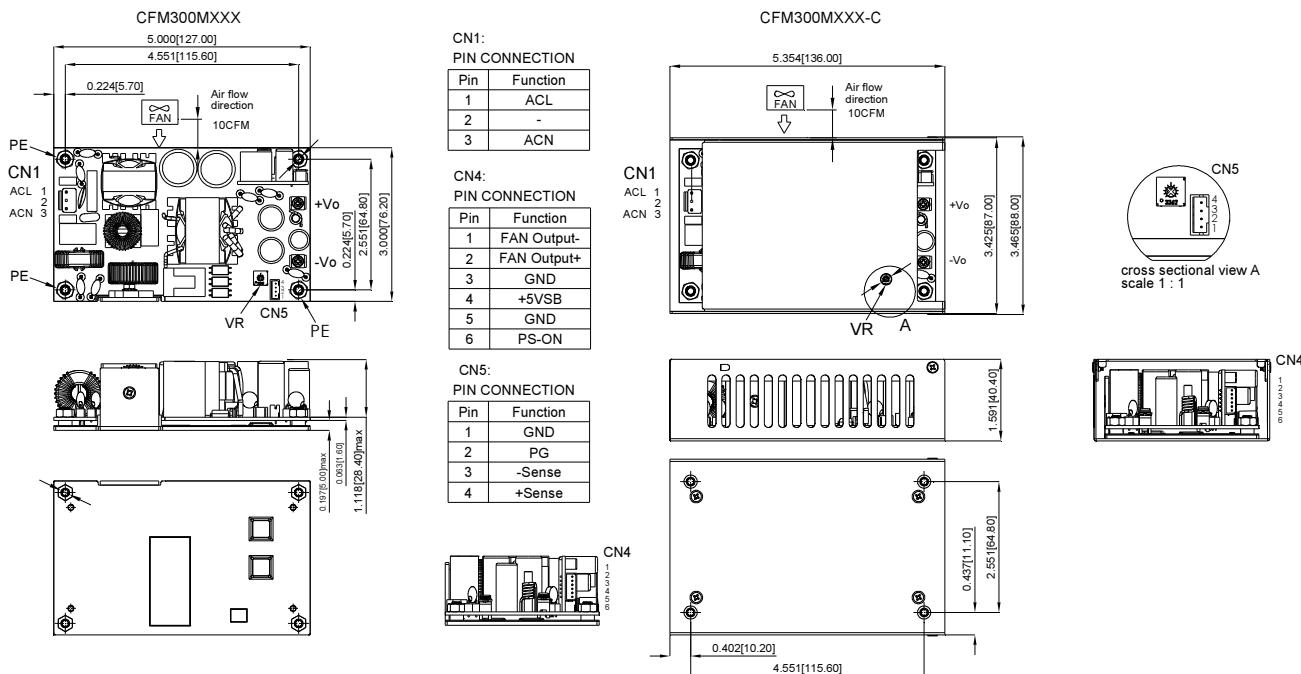


Figure 3. CFM300S series Mechanical Outline Diagram

**CINCON ELECTRONICS CO., LTD.**

**Headquarters:**

14F, No.306, Sec.4, Hsin Yi Rd. No. 8-1, Fu Kung Rd.  
Taipei, Taiwan  
Tel: 886-2-27086210  
Fax: 886-2-27029852  
E-mail:  
[support@cincon.com.tw](mailto:support@cincon.com.tw)  
Web Site:  
<http://www.cincon.com>

**Factory:**

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](mailto:info@cincon.com)