



# CFM150S Series

## Application Note V10 August 2019

### 150W AC-DC Power Supply with PFC CFM150S Series APPLICATION NOTE



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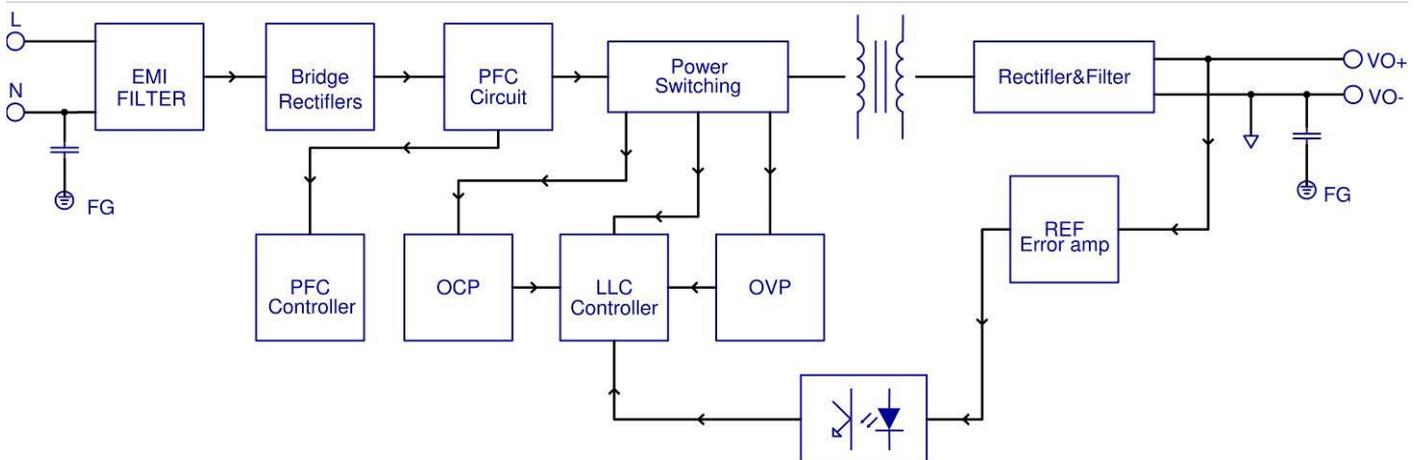
### 1. Introduction

This application note describes the features and functions of Cincon's CFM150S 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 CFM150S series power module is extremely reliable.

### 2. CFM150S Series Features

- Universal Input 90~264Vac
- 2"x 4" Open Frame Compact Size
- 120W with Natural Convection
- 150W with Base Cooling
- No Load Input Power Consumption<150mW
- Active PFC Function
- High Efficiency up to 94%
- Continuous Short Circuit Protection
- Meets IEC/EN60335-1/60601-1
- EMI Safety Meets Class I & Class II
- Operating Altitude 5000m

### 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)	See derating curve	All	90		264	Vac
Operating Temperature	See derating curve	All	-30		+80	°C
Storage Temperature		All	-40		+85	°C
Input/Output Isolation Voltage	1 minute	All	3000			Vac
Operating Altitude		All			5000	m

### 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	A
Leakage Current (Touch)		All			100	uA
Under Voltage Protection		All	60		75	V

### OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units	
Output Voltage Set Point	Vin=Nominal Vin, Io=Io .max, Tc=25°C.	CFM150S120(-B)	11.88	12	12.12	Vdc	
		CFM150S240(-B)	23.76	24	25.24		
		CFM150S280(-B)	27.72	28	28.28		
		CFM150S360(-B)	35.64	36	36.36		
		CFM150S480(-B)	47.52	48	48.48		
Output Voltage Adjustment	CFM150S ≤ Rated output power 120W CFM150S-B ≤ Rated output power 150W	CFM150S120(-B)	11.04		12.96	Vdc	
		CFM150S240(-B)	22.08		25.92		
		CFM150S280(-B)	25.76		30.24		
		CFM150S360(-B)	33.12		38.88		
		CFM150S480(B)	44.16		51.84		
Operating Output Current Range	CFM150SXXX Vin = 90Vac~200Vac see Typical Current Vin = 200Vac~264Vac see Max Current	CFM150S120(-B)		10	11.67	A	
		CFM150S240(-B)		5	5.83		
		CFM150S280(-B)		4.28	4.99		
		CFM150S360(-B)		3.33	3.88		
		CFM150S480(-B)		2.5	2.92		
	CFM150SXXX-B	CFM150S120(-B)				12.5	A
		CFM150S240(-B)				6.25	
		CFM150S280(-B)				5.35	
		CFM150S360(-B)				4.16	
		CFM150S480(-B)				3.125	
Holdup Time	Vin=115Vac	All	20	25		ms	

### Output Voltage Regulation

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Load Regulation	20% load to full load	All			±1.0	%
Line Regulation	Vin=high line to low line	All			±0.5	%



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PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Over Current Protection		All	170	180	190	%
Over Voltage Protection		CFM150S120(-B) CFM150S240(-B) CFM150S280(-B) CFM150S360(-B) CFM150S480(-B)	13.1 26.3 32.3 38.3 50.3		14.2 29.2 34.2 44.2 58.2	VDC
Output Ripple and Noise	1. Add a 0.1uF ceramic capacitor and a 10uF aluminum electrolytic capacitor to output. 2. Oscilloscope is 20MHz band width. 3. Ambient temperature=25°C	CFM150S120(-B) CFM150S240(-B) CFM150S280(-B) CFM150S360(-B) CFM150S480(-B)			120 240 280 360 480	mVp-p
Load Capacitance	1. Input voltage is 115VAC and 230VAC 2. Output is max. load	CFM150S120(-B) CFM150S240(-B) CFM150S280(-B) CFM150S360(-B) CFM150S480(-B)			12500 6200 5340 4100 3080	uF
Efficiency	1. Input voltage is 230VAC 2. Output is max. load	CFM150S120(-B) CFM150S240(-B) CFM150S280(-B) CFM150S360(-B) CFM150S480(-B)		93 94 94 94 94		%

### ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input to Output	1 minute (without dielectric breakdown)	All			3000	Vac
Input to Earth(Ground)	1 minute (without dielectric breakdown)	All			2500	Vac
Output to Earth(Ground)	1 minute (without dielectric breakdown)	All			360	Vac
Isolation Resistance		All	100			MΩ

### FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency		All		115		KHz



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### GENERAL SPECIFICATIONS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
MTBF	Io=100%; Ta=25°C per MIL-HDBK-217F	All	350			K hours
Weight		CFM150SXXX CFM150SXXX-B		200 240		g
Safety	Class I & Class II, IEC/EN/UL62368-1					
EMC Emission	EN55032 Class B ,EN61000-3-2:2014, EN6100-3-3:2013, EN61000-6-3:2012, EN61000-6-4:2011, 47 CFR FCC Part 15 Subpart B (Class B), Oct.2014					
Conducted disturbance	EN55032, FCC CFR 47 Part 15			Class B		
Radiated disturbance	EN55032, FCC CFR 47 Part 15 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	EN55024, EN61204-3:2000, EN61000-6-1:2007, EN61000-6-2:2005					
Electrostatic discharge (ESD)	IEC 61000-4-2:2008, Air discharge: ±8KV					
Radio-Frequency, Continuous Radiated Disturbance	IEC 61000-4-3:2010			Criteria A		
Electrical fast transient (EFT)	IEC 61000-4-4:2012, ±0.5KV, ±1 KV, ±2 KV			Criteria A		
Surge	IEC 61000-4-5:2014, L-N: ±0.5KV, ±1KV,			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% 10ms, Dip: 60% 100ms, Dip >95% 5000ms			Criteria A		
Voltage Interruptions	IEC 61000-4-11:2004, >95% 5000ms			Criteria B		



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### 5. Main Features and Functions

#### 5.1 Operating Temperature Range

The highly efficient design of Cincon's CFM150S series power modules has resulted in their ability to operate within ambient temperature environments from -30°C to 80°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 170% to 190% of rated current.

### 6. EMC & Safety

#### ■ Emission and Immunity

- EN55032 Class B, EN61000-3-2:2014
- EN6100-3-3:2013, EN61000-6-3:2012
- EN61000-6-4:2011, 47 CFR FCC Part 15, Subpart B (Class B), Oct.2014, EN55024, EN61204-3:2000
- EN61000-6-1:2007, EN61000-6-2:2005

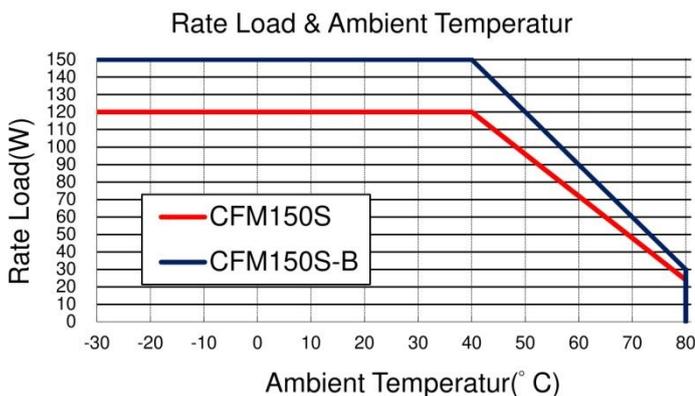
#### ■ Safety

- Class I & Class II, IEC/EN/UL62368-1

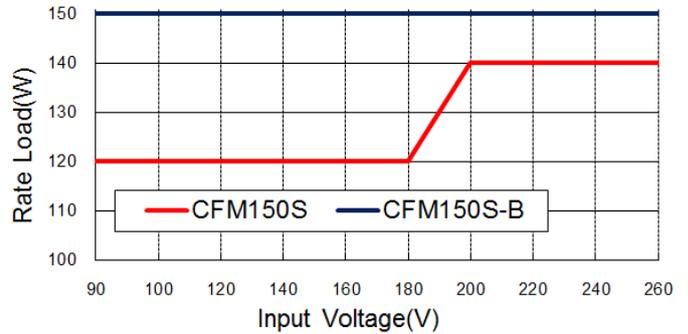
### 7. Applications

#### 7.1 Power De-Rating Curve

CFM150S Series Derating Curve



Rate Load & Input Voltage



#### 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 CFM150S 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:

- Vo is output voltage
- Io is output current
- Pin 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<sub>FL</sub> is the output voltage at full load
- V<sub>NL</sub> 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<sub>HL</sub> is the output voltage of maximum input voltage at full load.
- V<sub>LL</sub> is the output voltage of minimum input voltage at full load.

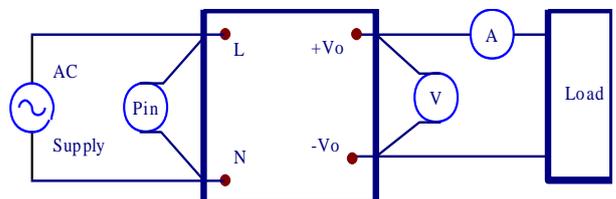


Figure 1. CFM150S Series Test Setup



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### 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  $C2=0.1\mu\text{F}$  ceramic capacitor and a  $C1=10\mu\text{F}$  electrolytic capacitor to output at 20 MHz Band Width.

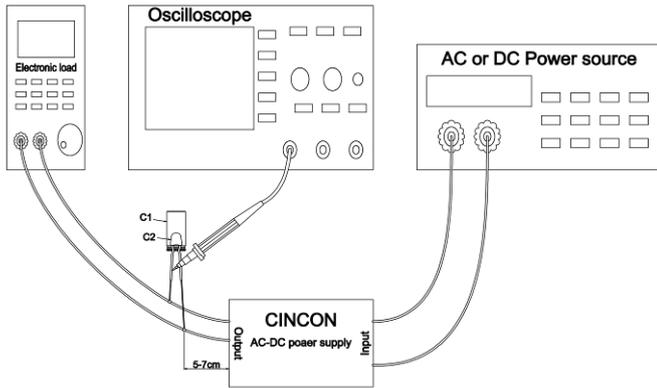
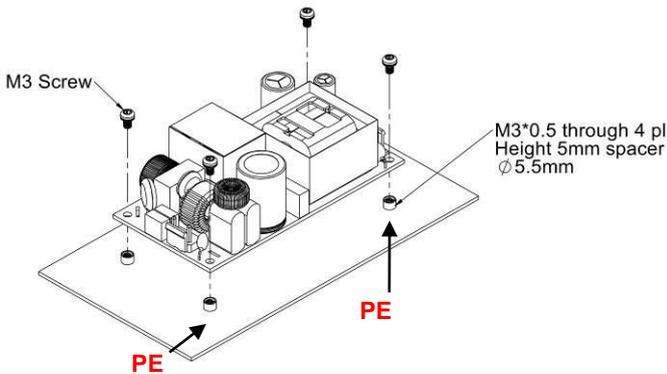


Figure 2. Output Voltage Ripple and Noise Measurement Set-Up

### 7.4 Installation Instruction

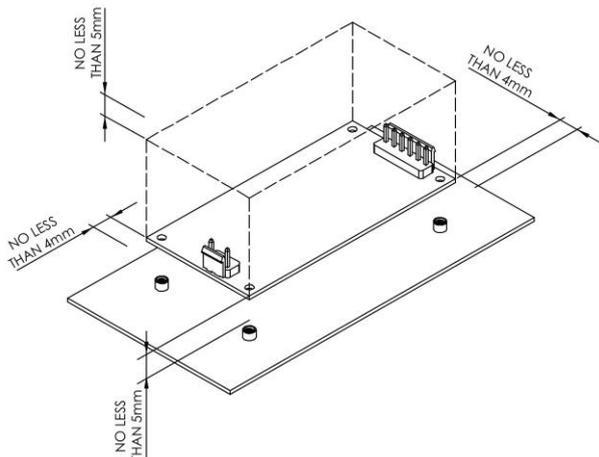
The CFM150S series has four 3.2mm diameter mounting holes. There are three type installations for CFM150S&CFM150S-B. Please use the mounting holes as follows:

Insert the spacer (5.5mm diameter max.) of 5mm height or more to mount the unit.



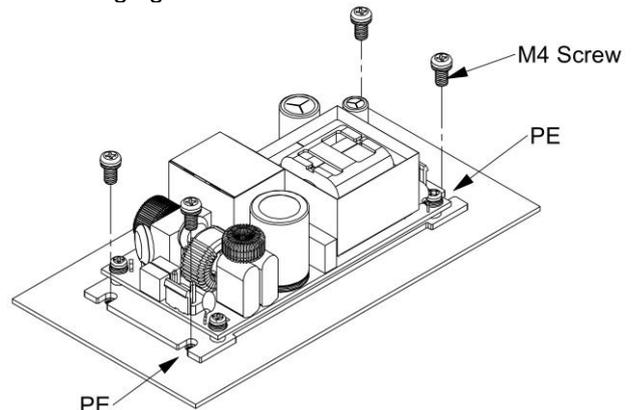
CFM150SXXX Installation Diagram

Note: M3 screw head and washer diameter shall not exceed 5.5mm.



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.

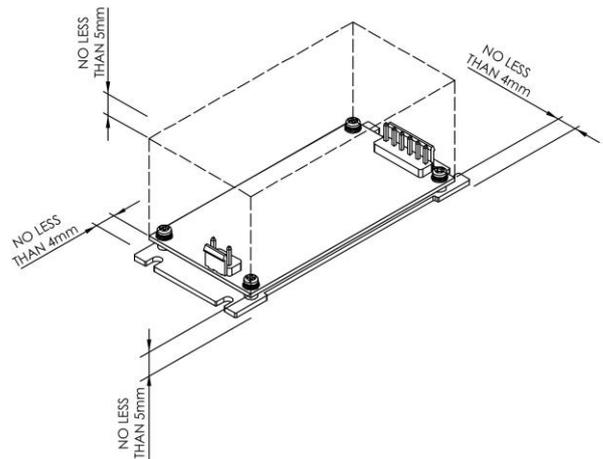
The CFM150S-B series provide the baseplate cooling for customer to increasing heat dissipation. Please refer to the following figure for installation.



CFM150SXXX-B installation diagram

Note: M4 screw head and washer diameter shall not exceed 5.5mm.

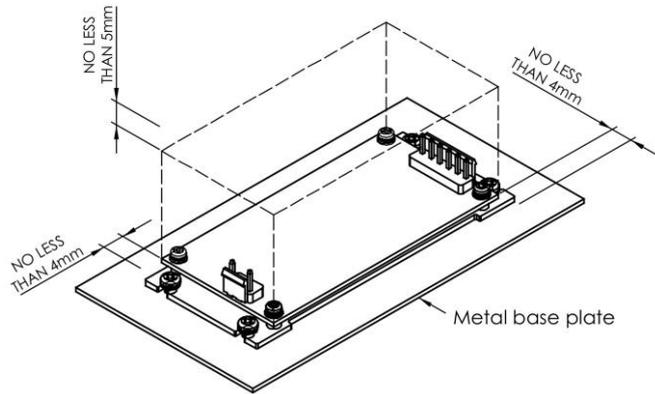
Please allow 4mm side clearance from the components and all side of the PCB. Allow 5mm clearance above the highest parts on the PCB. Be especially careful to allow 5mm between the solder side of the PCB and the mounting surface. If the clearances are not sufficient the specifications for isolation and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





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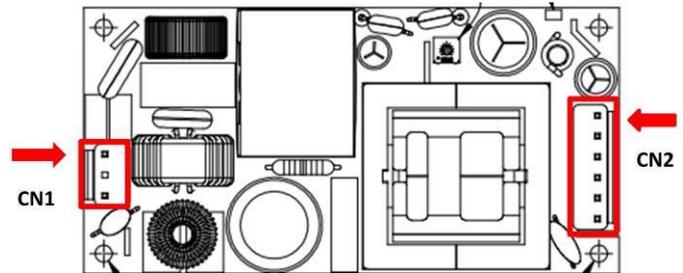
Base Cooling Setup

PE 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 CFM150S series Conduction EMI meets EN55032 Class B when test condition is Class I & Class II. Radiation meet EN55032 Class B when test condition is Class I for heavy industry & light industry. Radiation meet EN55032 Class A when test condition is Class II for heavy industry.

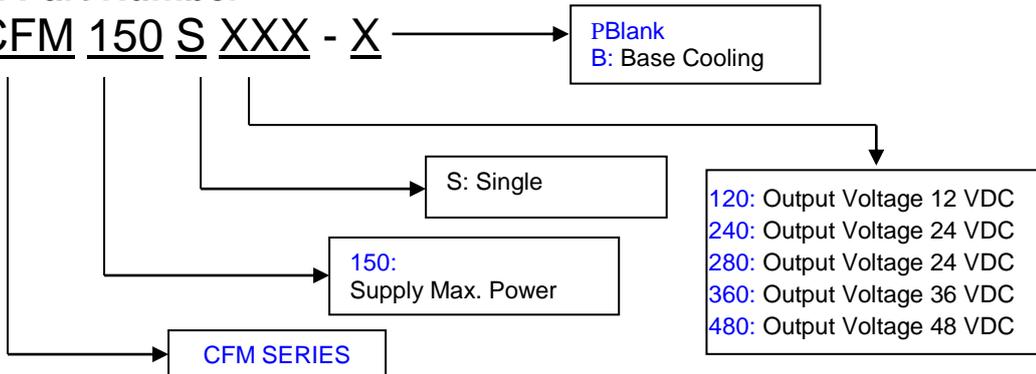
### 7.6 Mating Connectors



AC Input (CN1)	Wafer: TAIWAN KING PIN TERMINAL
DC Output (CN2)	PVHI series or equivalent.
	Housing: JST VHR series or equivalent.

### 8. Part Number

**CFM 150 S XXX - X**





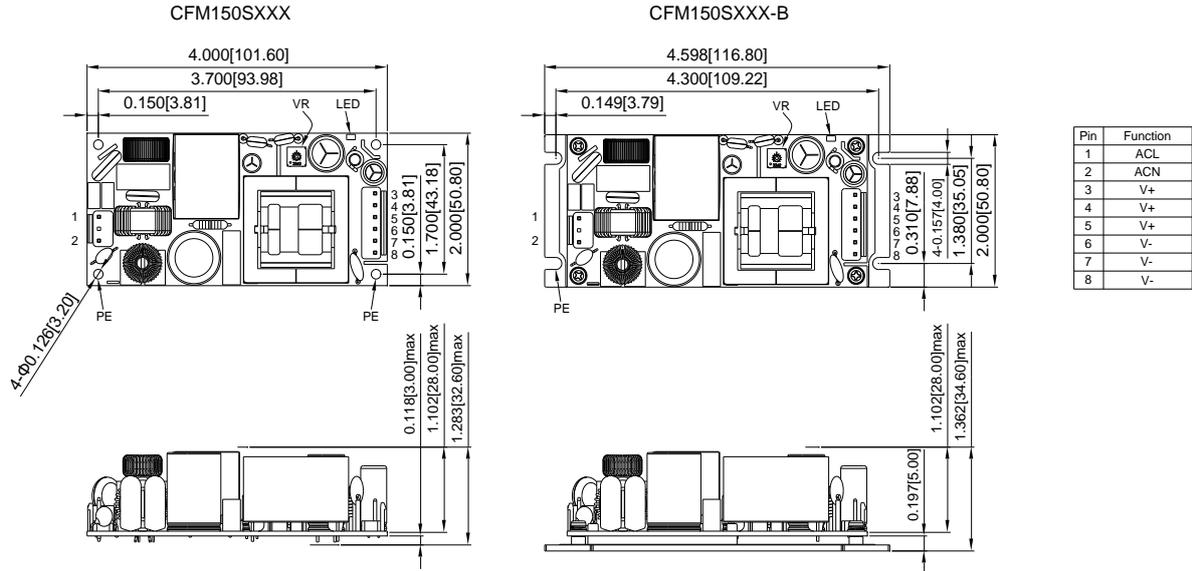
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### 9. CFM150S Series Mechanical Outline Diagrams

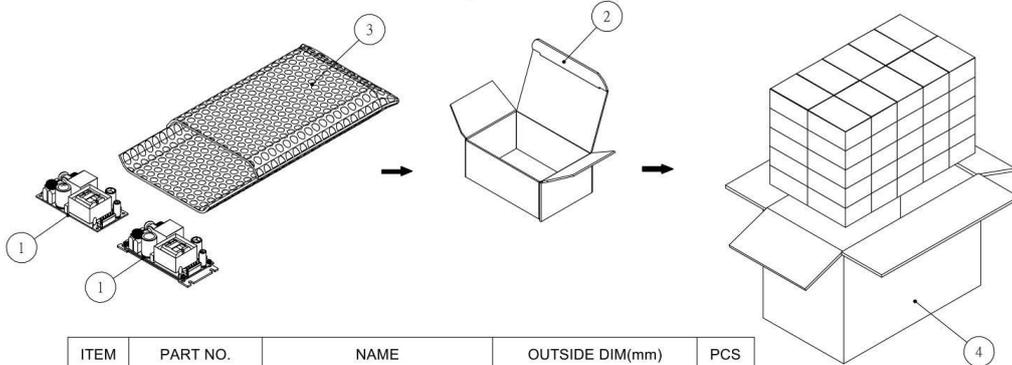
#### 9.1. Mechanical Outline Diagrams

All Dimensions are in inches[mm]  
Tolerance:Inches:X.XXX±0.02  
Millimeters:X.XX±0.5



#### 9.2. Packing Information

The packing information for CFM150S series is showing as follows:



ITEM	PART NO.	NAME	OUTSIDE DIM(mm)	PCS
1	-	CFM150SXXX or CFM150SXXX-B Product	454.5x266.6x312.1mm	50
2	G64214315	Inner Box	125x86x55mm	50
3	G64F00006	Antistatic Bag	155x185x65mm	50
4	G64112341	No.159 Cardboard Box	454.5x266.6x312.1mm	1

Each Box Packaging 50 PCS Products

CFM150SXXX  
Net weight Ref. 10 Kg  
Gross weight Ref. 11 Kg

CFM150SXXX-B  
Net weight Ref. 11.8 Kg  
Gross weight Ref. 12.8 Kg

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