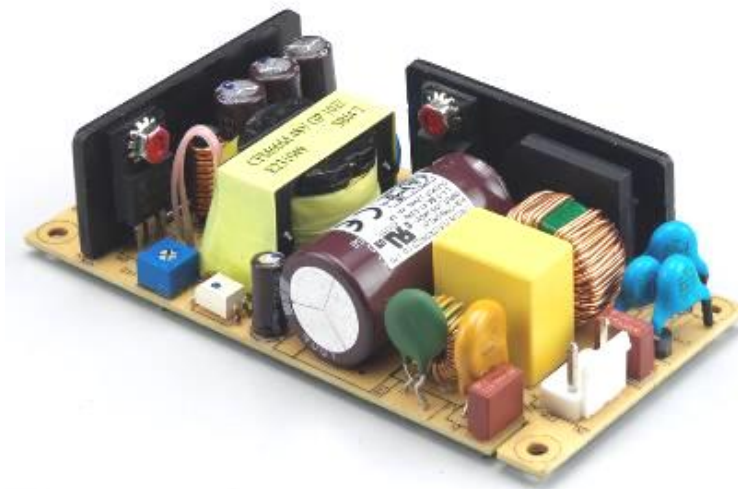




# CFM60M Series

## Application Note V11 July 2020

### AC-DC Switching Power Module CFM60M Series APPLICATION NOTE



Approved By:

Department	Approved By	Checked By	Written By
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		Ovid	
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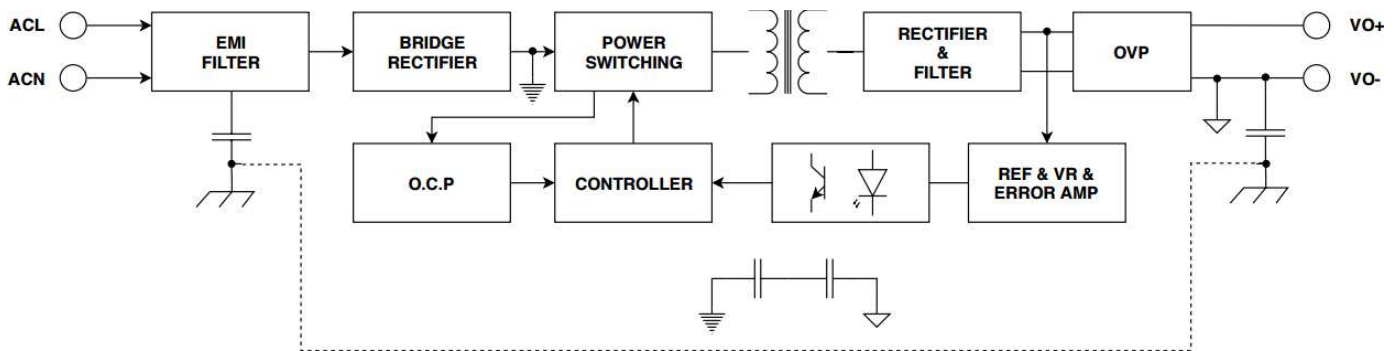
### 1. Introduction

This application note describes the features and functions of Cincon's CFM60M series of medical open frame, Isolated AC-DC Converters. These are highly efficient, reliable and 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 all CFM60M series converters are extremely reliable.

### 2. CFM60M Series Features

- Universal Input Range 90~264VAC
- 2" x 4" Size
- Efficiency to 90%
- Continuous Short Circuit Protection
- No Load Power Consumption < 0.5W
- Meets EN55011 and EN55032 Class B
- IEC/EN/UL 60601-1 2MOPP Approval
- IEC/EN/UL 60950-1 Approval
- Meets IEC/EN60335-1
- Meets Class I

### 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		All	90		264	Vac
			120		370	Vdc
Operating Temperature	See derating curve	All	-20		+70	°C
Storage Temperature		All	-20		+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			1.6	A
Leakage Current		All			100	uA
Inrush Current	Vin=240Vac, cold start at 25°C.	All			75	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.	CFM60M050	4.75	5.0	5.25	Vdc
		CFM60M120	11.40	12.0	12.60	
		CFM60M150	14.25	15.0	15.75	
		CFM60M240	22.80	24.0	25.20	
		CFM60M480	45.60	48.0	50.40	
Operating Output Current Range		CFM60M050			8	A
		CFM60M120			5	
		CFM60M150			4	
		CFM60M240			2.5	
		CFM60M480			1.25	
Holdup Time	Vin=115Vac	All		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 Voltage Protection	uses a TVS component to clamp output voltage	CFM60M050		6.8		VDC
		CFM60M120		15		
		CFM60M150		18		
		CFM60M240		30		
		CFM60M480		56		
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	CFM60M050			50	mVp-p
		CFM60M120			120	
		CFM60M150			150	
		CFM60M240			240	
		CFM60M480			480	



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PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Load Capacitance	1. Ambient temperature=25°C 2. Input voltage is 115VAC and 230VAC 3. Output is max. load	CFM60M050			8000	uF
		CFM60M120			5000	
		CFM60M150			4000	
		CFM60M240			2500	
		CFM60M480			1250	
Efficiency	Output is Rated Load Ambient temperature=25°C	CFM60M050		82		%
		CFM60M120		87		
		CFM60M150		88		
		CFM60M240		89		
		CFM60M480		90		

### ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input to Output	1 minute	All			4000	Vac
Input to Earth (Ground)	1 minute	All			1500	Vac
Output to Earth (Ground)	1 minute	All			500	Vac
Isolation Resistance		All	100			MΩ

### FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency		All	62	65	68	KHz
Output Voltage Adjustment	Pout=max rated power	All	-5		+5	%

### GENERAL SPECIFICATIONS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
MTBF	Io=100%; Ta=25°C per MIL-HDBK-217F	CFM60M050 Others	350 240			K hours
Weight		All		125		g
Safety	Class I, IEC60601-1, EN60601-1, ANSI/AAMI ES60601-1, EN 60950-1, IEC 60950-1, UL60950-1					Medical Ed. 3.1
EMC Emission	EN55011, EN 55032, EN 55024, Class B, EN60601-1-2, EN 61000-3-2, EN 61000-3-3, EN 61000-6-1, EN 61000-6-3, EN 61204-3, FCC CFR 47 Part 15, 18					Medical Ed. 4.0
Conducted disturbance	EN55011, EN55032, EN 55024, FCC CFR 47 Part 15, 18 Class B					
Radiated disturbance	EN55011, EN55032, EN 55024, FCC CFR 47 Part 15, 18 Class B					
Harmonic current emissions	IEC 61000-3-2:2014 Class A					
Voltage fluctuations & flicker	IEC 61000-3-3:2013					
EMC Immunity	IEC 61000-4-2, 3, 4, 5, 6, 8, 11					



# CFM60M Series

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### 5. Main Features and Functions

#### 5.1 Operating Temperature Range

Cincon's CFM60M series converters highly efficient converter design has resulted in its ability to operate ambient temperature environment (-20 °C to 70 °C). Due consideration must be given to the de-rating curves when ascertaining maximum power that can be drawn from the converter. The maximum power 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 Voltage Adjustment

The output voltage on all models is in the range from +5% to -5%, but can't exceed the watt value of the products.

#### 5.3 Output 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 supply up to 120% of rated current. In the event of an over current converter will go into a hiccup mode protection.

### 6. EMC & Safety

#### ■ Emission and Immunity

Medical(Ed. 4.0):

EN55011 Class B, IEC61000-3-2, IEC61000-3-3, FCC CFR 47 Part 18, CISPR 11, EN 60601-1-2

I.T.E:

EN 55032 Class B, EN55024, FCC CFR 47 Part 15, CISPR 22, IEC61000-3-2, IEC61000-3-3, EN 61000-6-1, EN 61000-6-3, EN 61204-3

IEC61000-4-2, IEC61000-4-3, IEC61000-4-4, IEC61000-4-5, IEC61000-4-6, IEC61000-4-8, IEC61000-4-11,

#### ■ Safety

Medical(Ed. 3.1):

Class I, IEC 60601-1, EN 60601-1, ANSI/AAMI ES60601-1

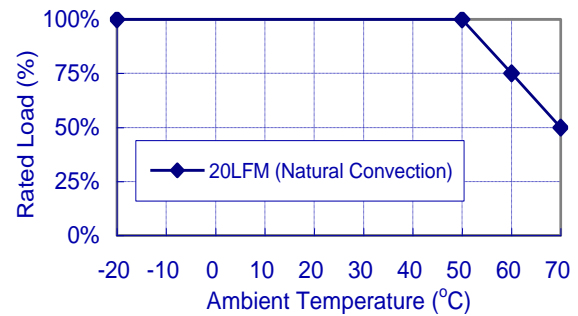
I.T.E:

IEC 60950-1, EN 60950-1, UL60950-1

### 7. Applications

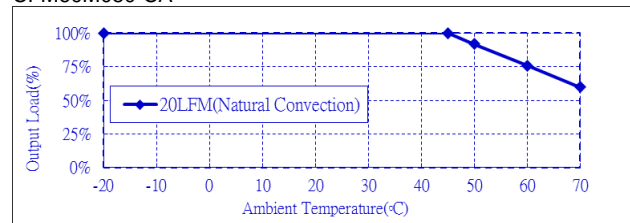
#### 7.1 Power De-Rating Curve

Open Frame versions:



#### Covered versions:

CFM60M050-CA



#### 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 CFM60M 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:

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

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.



# CFM60M Series

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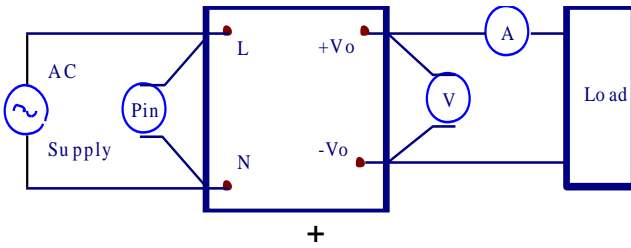


Figure 1. CFM60M Series Test Setup

### 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 10uF electrolytic capacitor to output at 20 MHz band width.

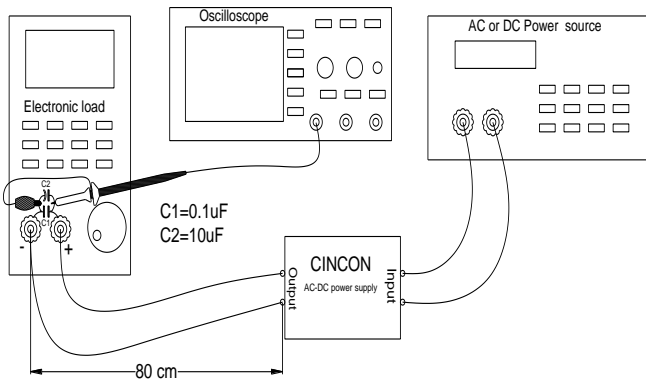
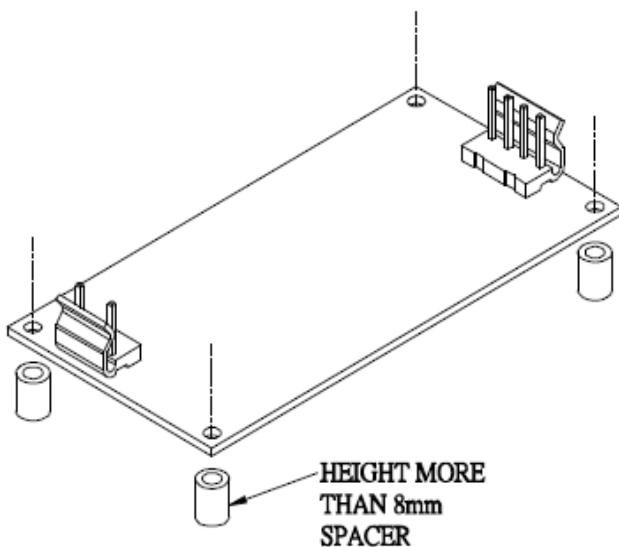


Figure 2. Output Voltage Ripple and Noise Measurement Set-Up

### 7.4 Installation Instruction

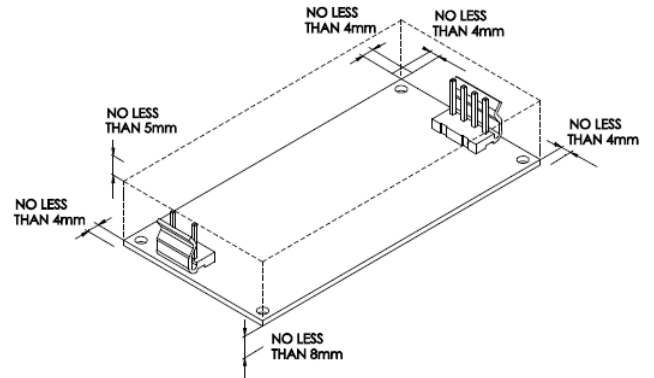
The CFM60M series has four 3.2mm diameter mounting holes. Please use the mounting holes as follows:

Insert the spacer (6mm diameter max.) of 8mm height or more to mount the unit. The vibration specification applies when the unit is mounted on 8mm spacers.

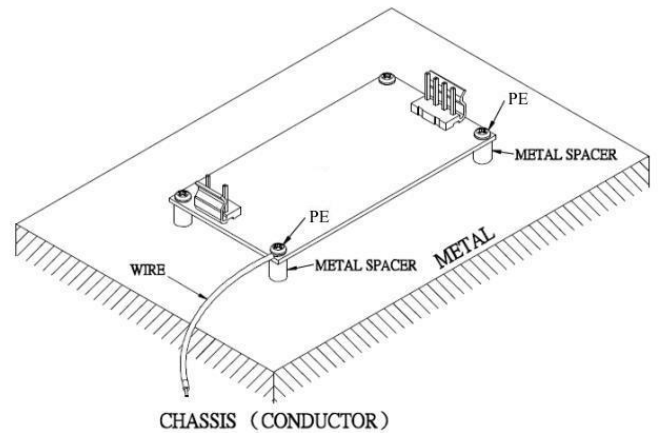


Please allow 4mm side clearance from the components and all side of the PCB. Allow 5mm clearance above the highest parts on the PCB. Be especially careful to allow 8mm between the solder side of the PCB and the

mounting surface. If the clearances are not sufficient, the specifications for isolation and withstand will not be valid.



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



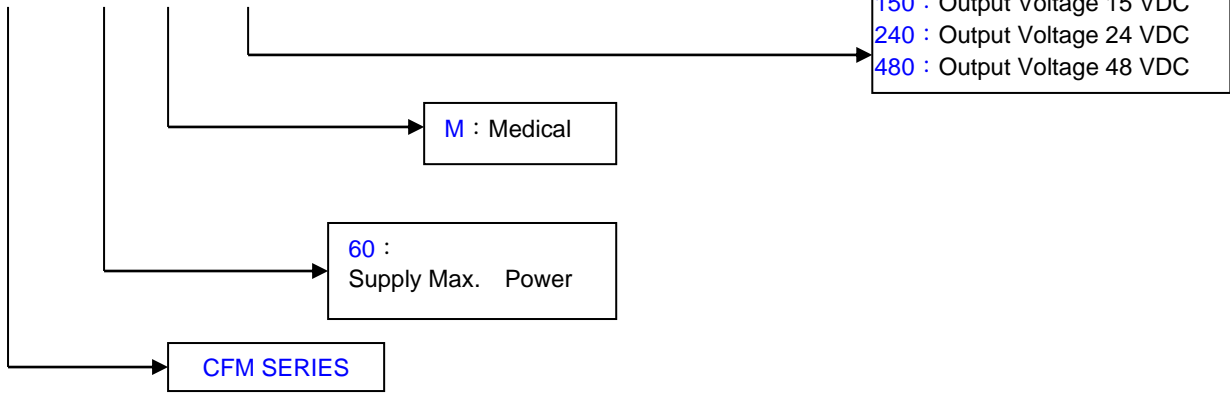


# CFM60M Series

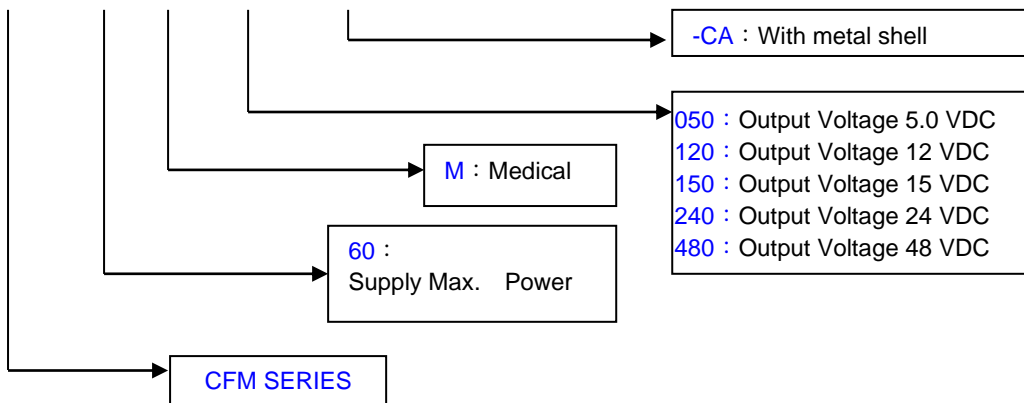
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### 8. Part Number

CFM XX M XXX



CFM XX M XXX -CA







# CFM60M Series

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### 9. CFM60M Series Mechanical Outline Diagrams

#### 9.1. Mechanical Outline Diagrams

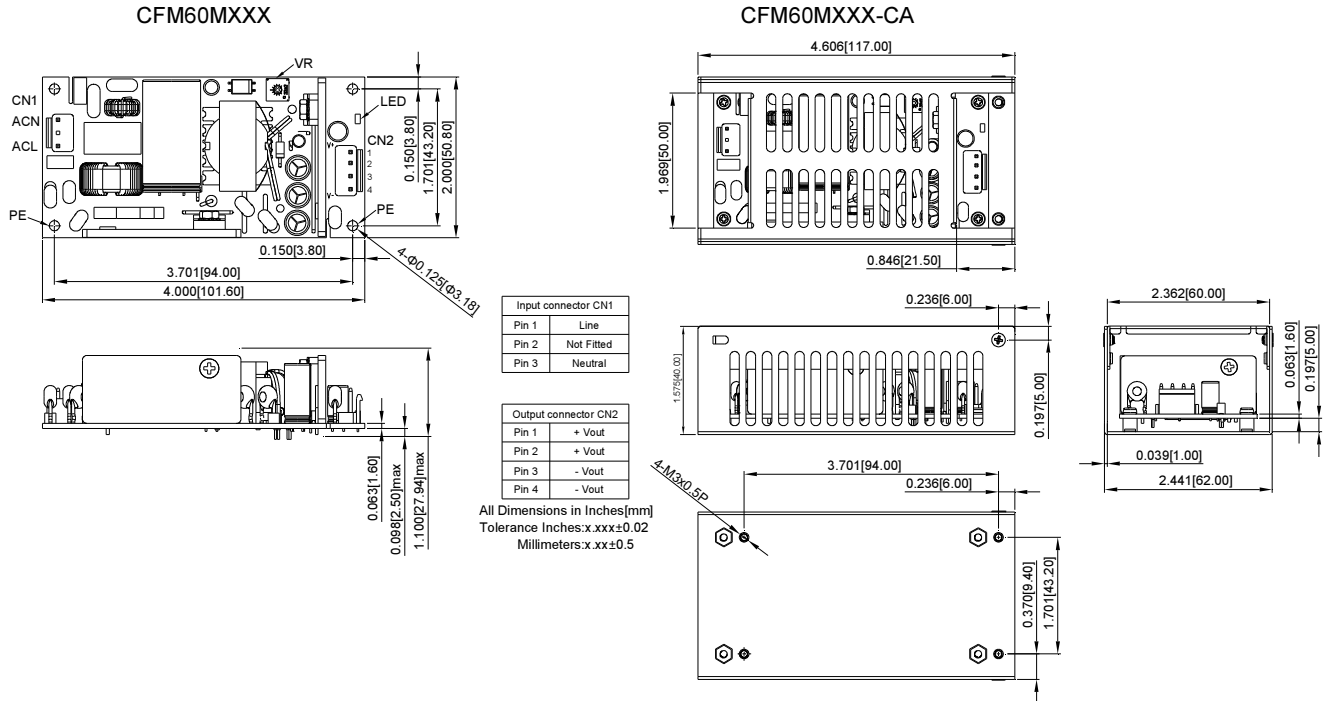
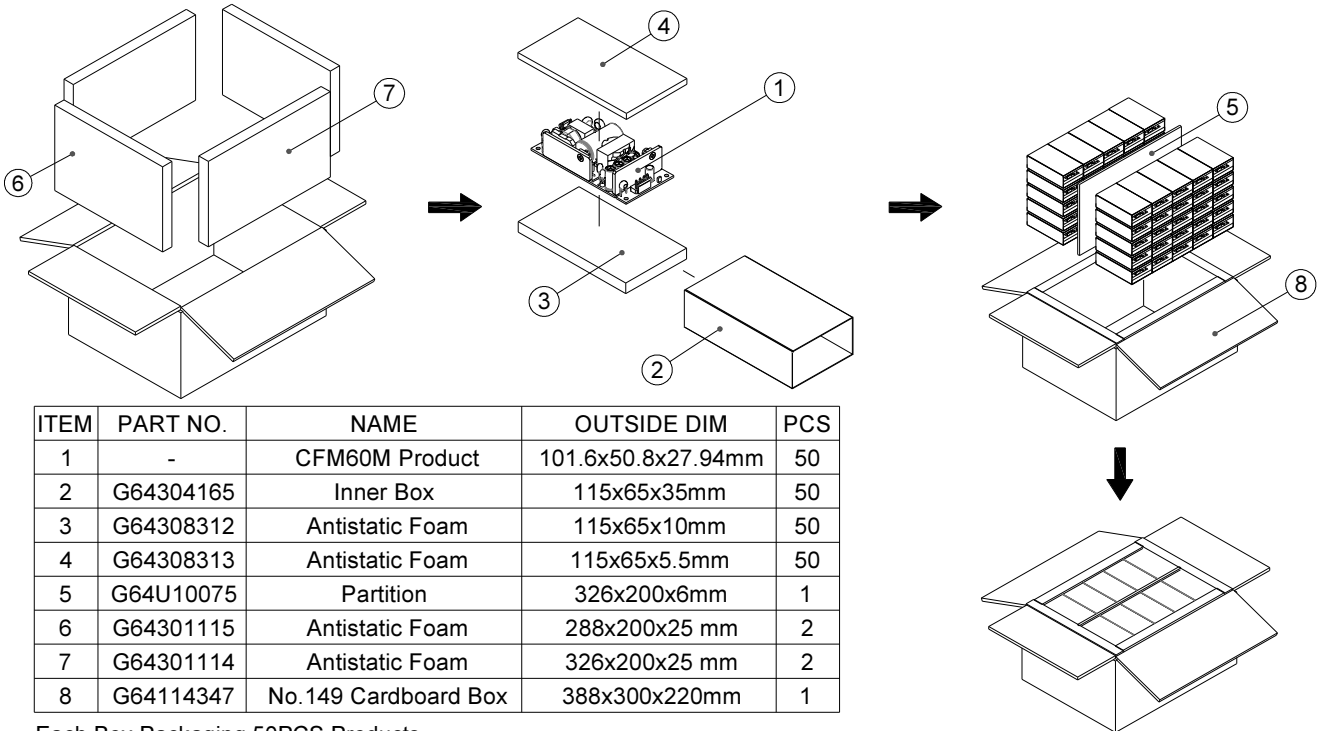


Figure 3. CFM60M series Mechanical Outline Diagram

#### 9.2. Packing Information

The packing information for CFM60MXXX series is showing as follows:



Each Box Packaging 50PCS Products

Net weight Ref. 6.3 Kg

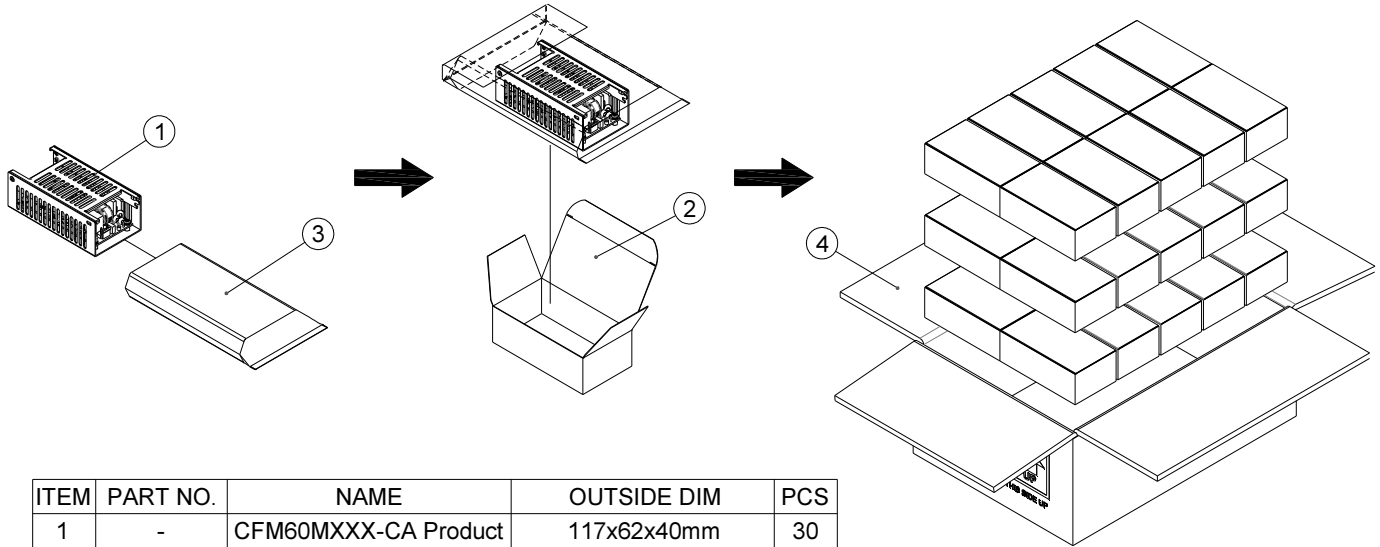
Gross Weight Ref. 7.8Kg



# CFM60M Series

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The packing information for CFM60MXXX-CA series is showing as follows:



ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	-	CFM60MXXX-CA Product	117x62x40mm	30
2	G64304071	Inner Box	121.5x66x42mm	30
3	G64D15057	Plastic Bag	0.08x155x2450mm	30
4	G64112339	No.59 Cardboard Box	360.6x257.6x148.5mm	1

Each Box Packaging 30PCS Products  
Gross Weight Ref. 6.5Kg

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