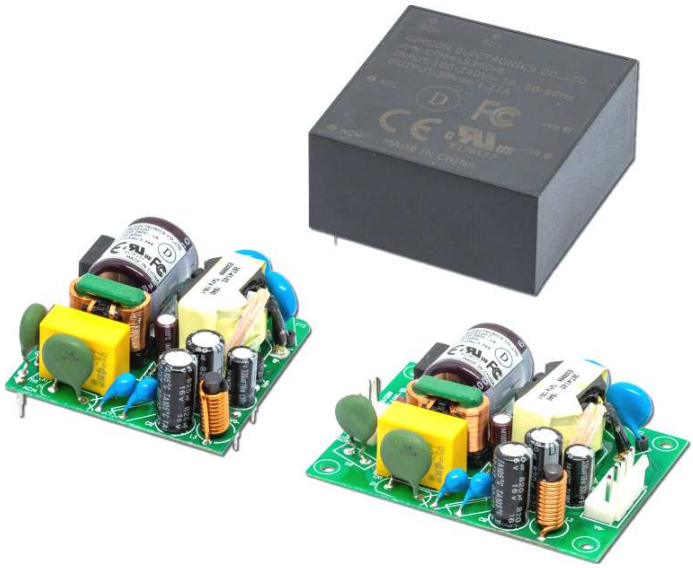
40W AC-DC Switching Power Module
CFM41S Series
APPLICATION NOTE



Approved By:

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Content

CFM41S Series

Application Note V14 August 2020

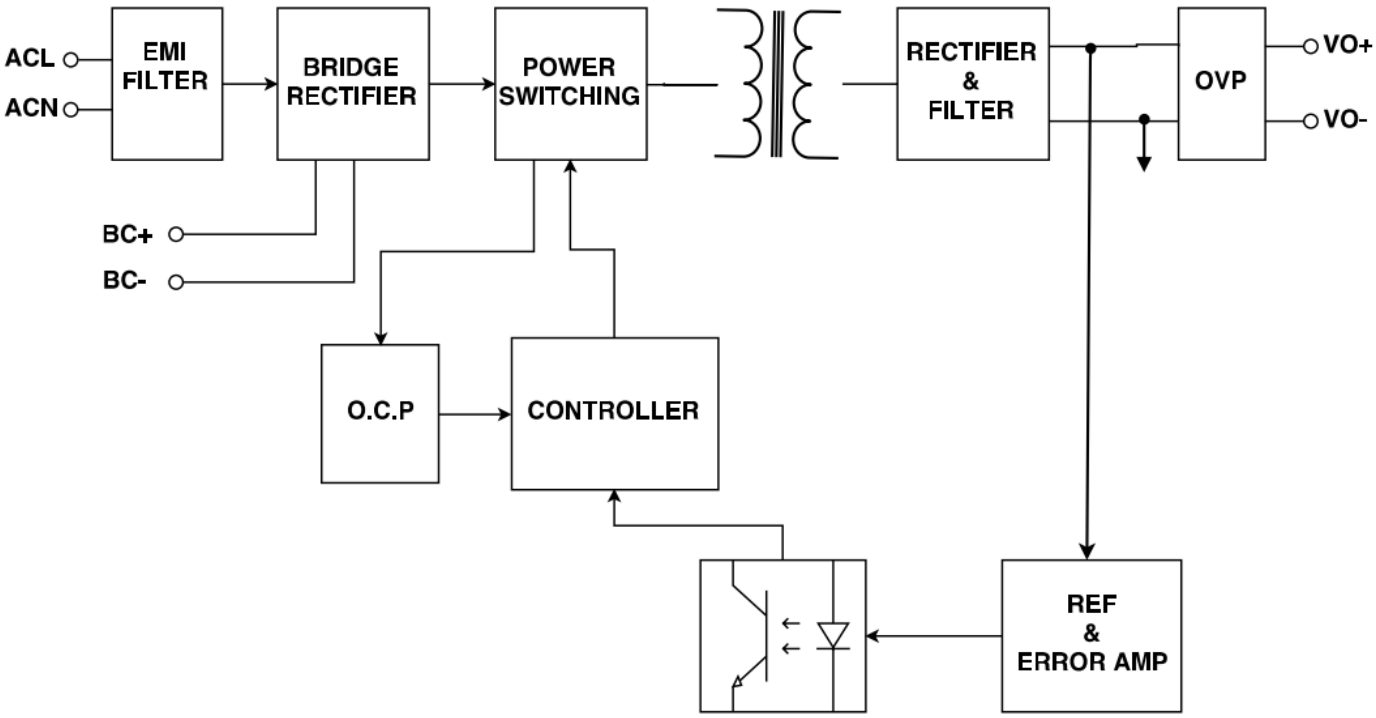
1. Introduction

This application note describes the features and functions of Cincon's CFM41S 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 CFM41S series power module is extremely reliable.

2. CFM41S Series Features

- Universal Input 90~264VAC
- EN55032 Class B and CISPR/FCC Class B
- IEC/EN/UL62368-1
- Meets IEC/EN60335-1
- Continuous Short Circuit Protection
- Over Voltage Protection
- No Load Input Power < 0.15W
- Peak Load (2 Times of Rated Current
- Class II, 2"x2" Compact Size

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		All	90		264	Vac
			120		370	Vdc
Operating Temperature	See derating curve	All	-40		85	℃
Storage Temperature		All	-40		85	℃
Input/Output Isolation Voltage	1 minute	All			3000	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	A
Leakage Current		All			0.25	mA
Inrush Current	Vin=240Vac, cold start at 25℃.	All			70	A

OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Set Point	Vin=Nominal Vin, Io=Io.max, Tc=25℃.	CFM41S050	4.9	5	5.1	Vdc
		CFM41S120	11.88	12	12.12	
		CFM41S150	14.85	15	15.15	
		CFM41S240	23.76	24	24.24	
		CFM41S360	35.64	36	36.36	
		CFM41S480	47.52	48	48.48	
Operating Output Current Range		CFM41S050			6	A
		CFM41S120			3.34	
		CFM41S150			2.67	
		CFM41S240			1.67	
		CFM41S360			1.11	
		CFM41S480			0.83	
Holdup Time	Vin=115Vac	All		10		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	CFM41S050		6.8		VDC
		CFM41S120		15		
		CFM41S150		18		
		CFM41S240		30		
		CFM41S360		43		
		CFM41S480		56		

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Ripple and Noise	1. Add a 0.1uF ceramic capacitor and a 10uF aluminum electrolytic capacitor to output.(CFM41S050: Add a 0.1uF ceramic capacitor and a 47uF aluminum electrolytic capacitor to output.) 2. Oscilloscope is 20MHz band width. 3. Ambient temperature=25℃	CFM41S050 CFM41S120 CFM41S150 CFM41S240 CFM41S360 CFM41S480			100 120 150 240 360 480	mVp-p
Load Capacitance	1. Ambient temperature=25℃ 2. Input voltage is 115VAC and 230VAC 3. Output is max. load	CFM41S050 CFM41S120 CFM41S150 CFM41S240 CFM41S360 CFM41S480			6000 3330 2650 1650 1090 810	uF
Efficiency	Output is rated load Ambient temperature=25℃ @ Input voltage is 230VAC	CFM41S050 CFM41S120 CFM41S150 CFM41S240 CFM41S360 CFM41S480		87 90 90 90 90 90		%

ISOLATION CHARACTERISTICS

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

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency		All		65		KHz

GENERAL SPECIFICATIONS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
MTBF	Io=100%; Ta=25℃ per MIL-HDBK-217F	All	350			K hours
Humidity	Nom-condensing	All			93	% RH
Shock	Mests MIL-STD-810F Table 516.5,TABLE 516.5-1 10ms, each axis 3 times(+-X、Y、Z axis)	All		75		g
Vibration	Mests MIL-STD-810F Table 514.5C-VIII,15~2000Hz, X、Y、Z axis,1 hr(each axis),. toal 3 hrs.	All		4		G
Weight		CFM41SXXX CFM41SXXX-E CFM41SXXX-T		61 142 64		g
Safety	Class II, IEC/EN/UL62368-1					
EMC Emission	EN55032 Class B, EN61000-3-2:2014, EN61000-3-3:2013, EN61000-6-3:2012, EN61000-6-4:2011, 47 CFR FCC Part 15 Subpart B (Class B), Oct.2014					
Conducted disturbance	EN55032, EN61000-6-3:2012, Class B, 47 CFR FCC Part 15 Subpart B (Class B)					
Radiated disturbance	EN55032, EN61000-6-3:2012, Class B, 47 CFR FCC Part 15 Subpart B (Class B)					
Harmonic current emissions	EN61000-3-2:2014					
Voltage fluctuations & flicker	EN61000-3-3:2013					
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					Criterion A
Radio-frequency, Continuous radiated disturbance	IEC 61000-4-3:2010					Criterion A
Electrical fast transient (EFT)	IEC 61000-4-4:2012, ±0.5KV, ±1 KV, ±2 KV					Criterion A
Surge	IEC 61000-4-5:2014, L-N: ±0.5kv, ±1kv,					Criterion A
Conducted disturbances, induced by RF fields	IEC 61000-4-6:2013					Criterion A
Power frequency magnetic field	IEC 61000-4-8:2009					Criterion A
Voltage dips	IEC 61000-4-11:2004, Dip: 30% 10ms, Dip: 60% 100ms, Dip >95% 5000ms					Criterion A
Voltage interruptions	IEC 61000-4-11:2004, >95% 5000ms					Criterion B

5. Main Features and Functions

5.1 Operating Temperature Range

The highly efficient design of Cincon's CFM41S series power modules has resulted in their ability to operate within ambient temperature environments from -30^{0}C to 80^{0}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:

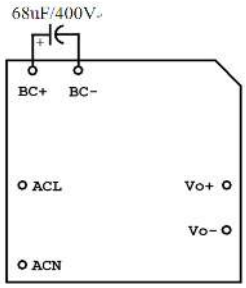
- Input voltage range
- Permissible Output load (per derating curve)

5.2 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.

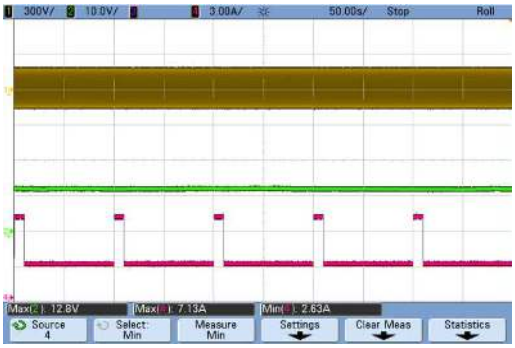
5.3 Peak Load Function

CFM41SXXX and CFM41SXXX-E has a very powerful peak load function which can provide twice the rated power. However, the duration of the peak load should be less than 10 seconds, with a maximum 10% duty cycle and must externally add a 68uF/400V capacitor to BC+ & BC-, but this is not needed when input is exceed to 200Vac.



Vin= 90Vac&115Vac&230Vac&264Vac

Peak Load Function by 200% Load 10S & 80% Load 90S



CH1: Vin, CH2: Vout, CH4: Iout

Average Power: 36.87W

Add External 68uF/400V Capacitor to BC+ & BC-.

Vin=230Vac&264Vac

Peak Load Function by 200% Load 10S & 80% Load 90S

CH1: Vin CH2: Vout CH4: Iout

Average Power: 36.87W

6. EMC & Safety

■ Emission and Immunity

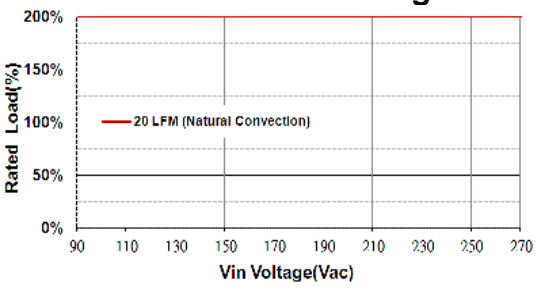
EN55032 Class B, EN61000-3-2:2014, EN61000-3-3:2013, EN61000-6-3:2012, EN61000-6-4:2011, 47 CFR FCC Part 15 Subpart B (Class B), Oct.2014, EN55024, EN61204-3:2000, EN61000-6-1:2007, EN61000-6-2:2005

■ Safety

Class II, IEC/EN/UL62368-1

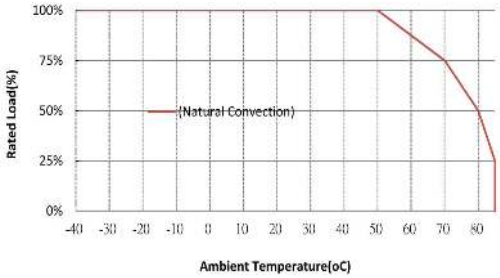
7. Applications

7.1 Peak Load Vin De-Rating Curve

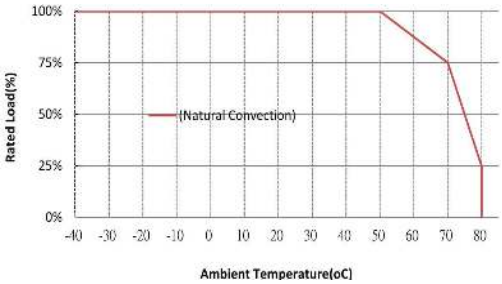


7.2 Power De-Rating Curve

7.2.1 CFM41SXXX、CFM41SXXX-E



7.2.2 CFM41SXXX-T



7.3 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 CFM41S 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:

Where:

Vo is output voltage

Io is output current

Pin is input power

The value of load regulation is defined as:

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.

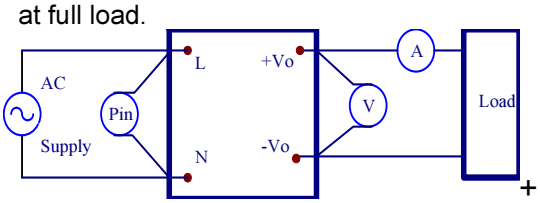


Figure 1. CFM41S Series Test Setup

7.4 Output Ripple and Noise Measurement

The test set-up for noise and ripple measurements is shown in Figure 2 Measured method:

Add a 0.1 uF ceramic capacitor and a 10 uF electrolytic capacitor to output at 20 MHz Band Width.(CFM41S050: Add a 0.1uF ceramic capacitor and a 47uF aluminum electrolytic capacitor to output.)

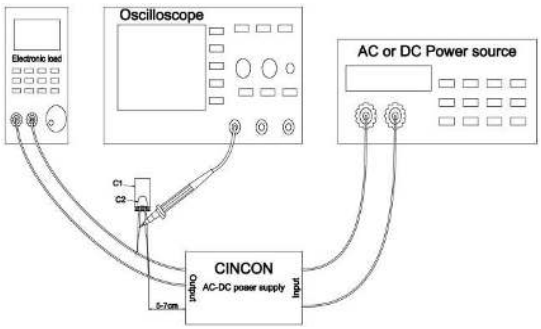
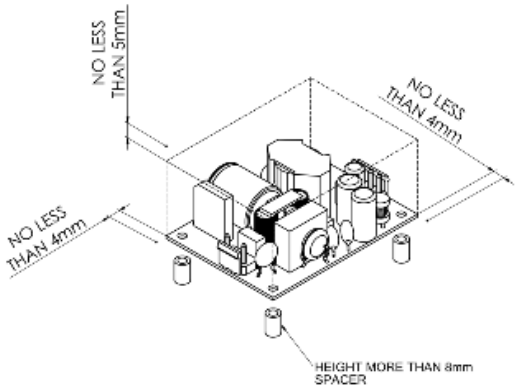


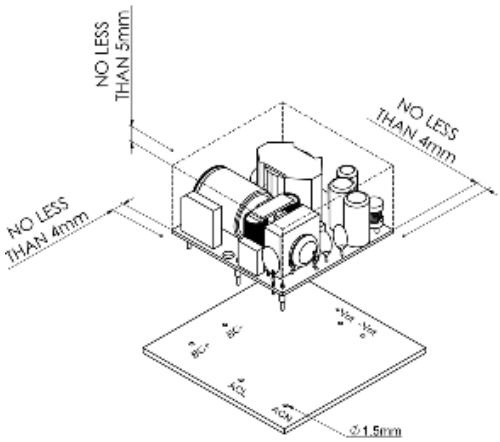
Figure 2. Output Voltage Ripple and Noise Measurement Set-Up

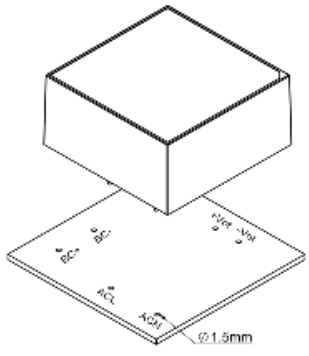
7.5 Installation Instruction

The CFM41SXXX-T has four 3.5mm 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.



The CFM41SXXX and CFM41SXXX-E mounting holes are 1.5mm. Please allow 4mm side clearance from the components and all side of the PCB and CASE. Allow 5mm clearance above the highest parts on the PCB and CASE.

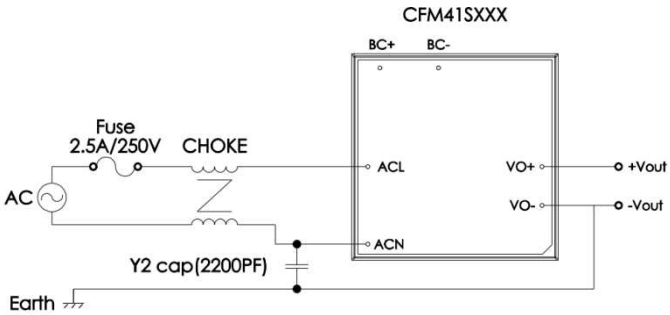




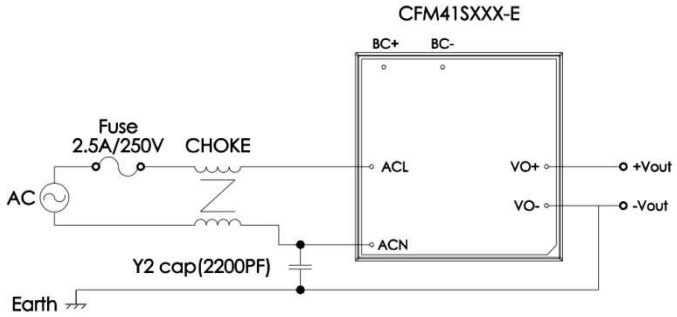
7.6 Class I EMI Solution

The CFM41S series need additional inductance and YCap to meet EN55032 CLASS B when test condition is Class I.If customers use in Class II systems, please ignore this section.

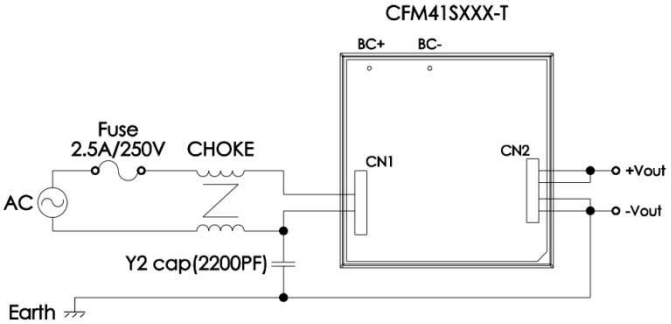
CFM41SXXX



CFM41SXXX-E



CFM41SXXX-T



Additional Inductance related parameters:

Specification	Inductance	Duplex Winding /turns	Manufacturers
T10*6*5C R15K	3.34mH	TEX-E Φ0.35*2/25T	VAKOS

Additional Safety YCap related parameters:

Subclass	WITHSTANDVOLTAGE	Capacitance	Manufacturers
Y2 CAP	250V(min)	2200pF(typ.)	TDK

8. Part Number

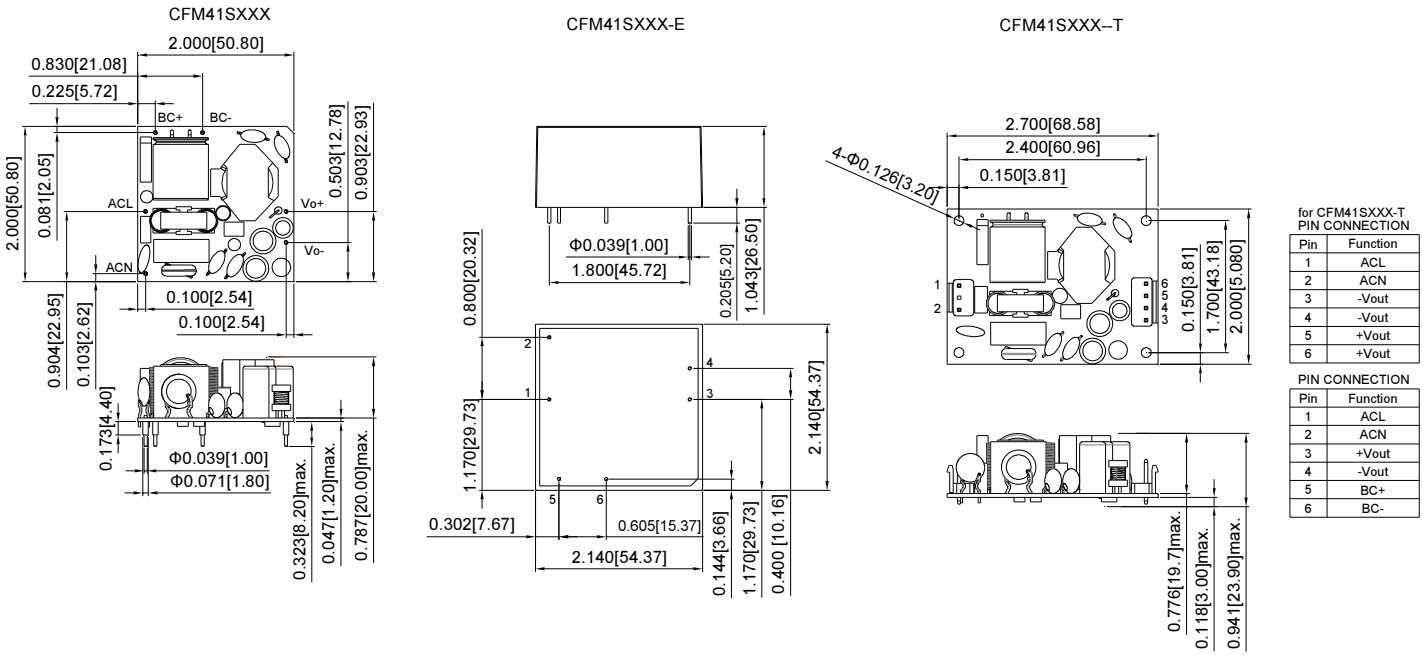
CFM XX S XXX-X

- Blank: PCB Mount
  E: Encapsulated
  T: WAFER
- 050：Output Voltage 5.0 VDC
  120：Output Voltage 12 VDC
  150：Output Voltage 15 VDC
  240：Output Voltage 24 VDC
  360：Output Voltage 36 VDC
  480：Output Voltage 48 VDC
- S：Single
- 41：
  Supply Max. Power
- CFM SERIES

9. CFM41S 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



for CFM41SXXX-T
PIN CONNECTION

Pin	Function
1	ACL
2	ACN
3	-Vout
4	-Vout
5	+Vout
6	+Vout

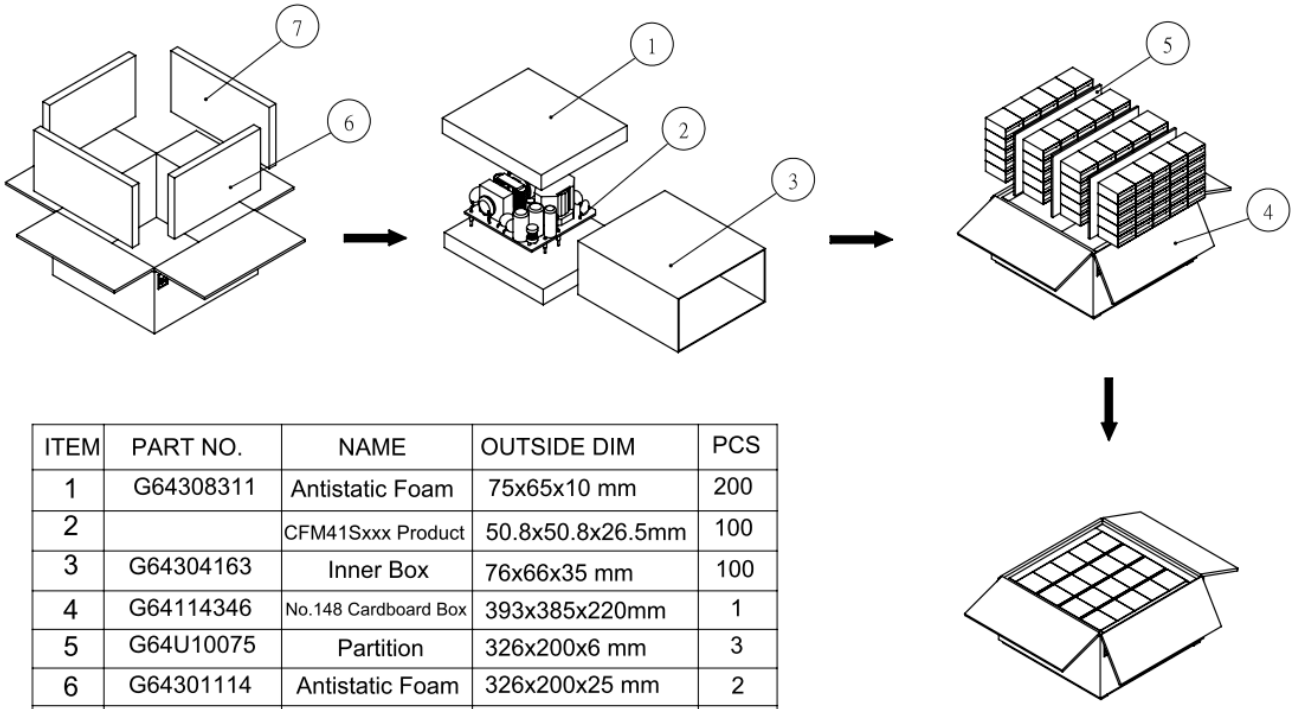
PIN CONNECTION

Pin	Function
1	ACL
2	ACN
3	+Vout
4	-Vout
5	BC+
6	BC-

Figure 3. CFM41S series Mechanical Outline Diagram

9.2 Packing Information

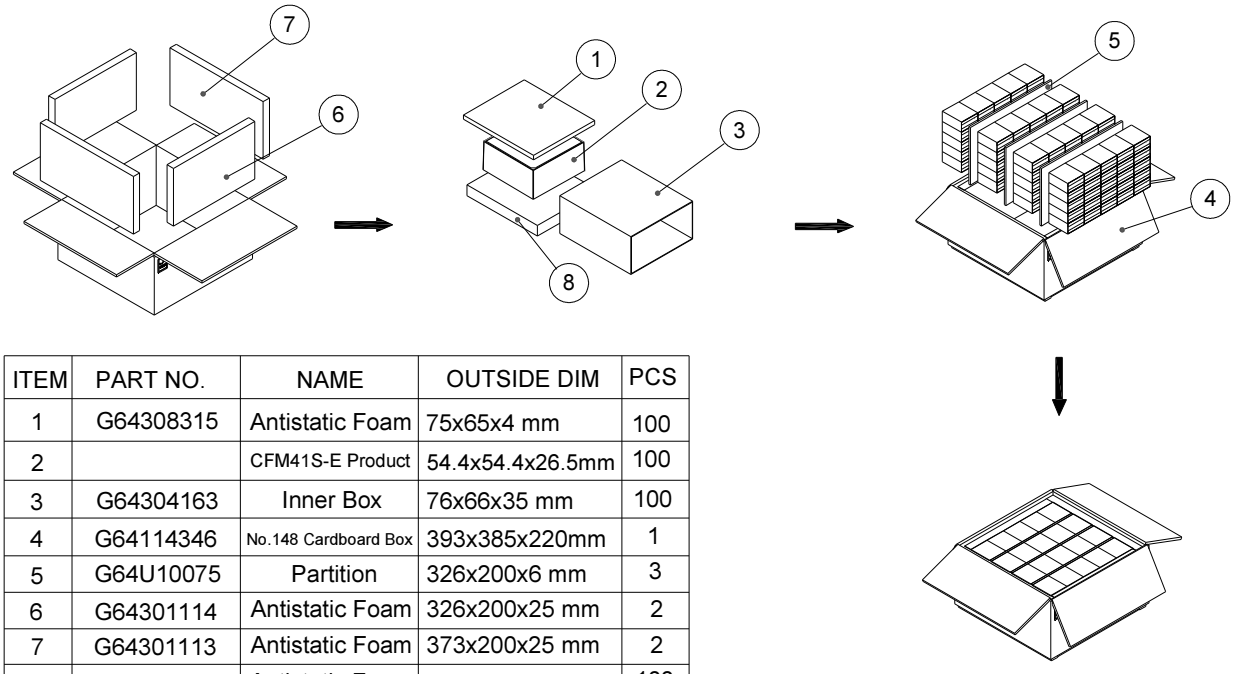
The packing information for CFM41SXXX series is showing as follows:



ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	G64308311	Antistatic Foam	75x65x10 mm	200
2		CFM41Sxxx Product	50.8x50.8x26.5mm	100
3	G64304163	Inner Box	76x66x35 mm	100
4	G64114346	No.148 Cardboard Box	393x385x220mm	1
5	G64U10075	Partition	326x200x6 mm	3
6	G64301114	Antistatic Foam	326x200x25 mm	2
7	G64301113	Antistatic Foam	373x200x25 mm	2

Each Box Packaging 100 PCS Products
Gross weight Ref. 7.7Kg
Net weight Ref. 6.7Kg

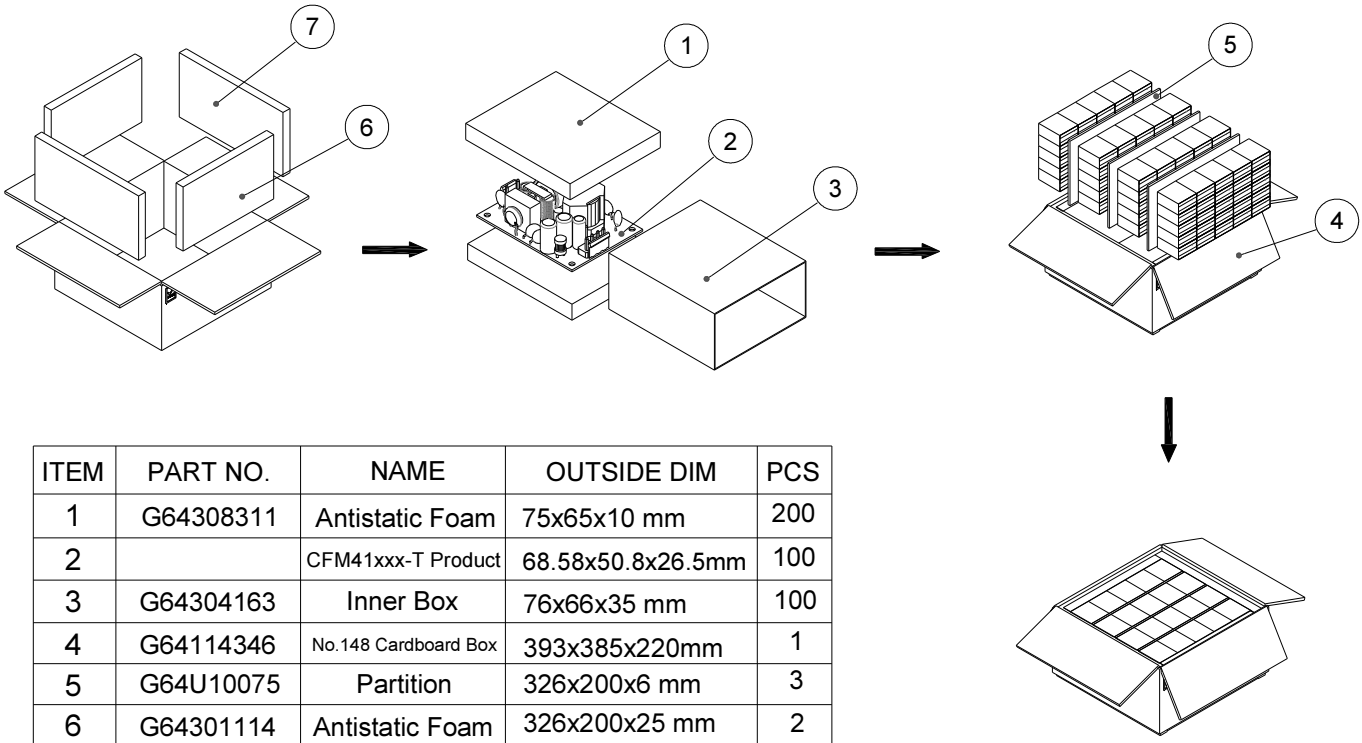
The packing information for CFM41SXXX-E series is showing as follows:



ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	G64308315	Antistatic Foam	75x65x4 mm	100
2		CFM41S-E Product	54.4x54.4x26.5mm	100
3	G64304163	Inner Box	76x66x35 mm	100
4	G64114346	No.148 Cardboard Box	393x385x220mm	1
5	G64U10075	Partition	326x200x6 mm	3
6	G64301114	Antistatic Foam	326x200x25 mm	2
7	G64301113	Antistatic Foam	373x200x25 mm	2
8	G64308311	Antistatic Foam	75x65x10 mm	100

Each Box Packaging 100 PCS Products
Gross weight Ref. 15.5Kg
Net weight Ref. 14.5Kg

The packing information for CFM41SXXX-T series is showing as follows:



ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	G64308311	Antistatic Foam	75x65x10 mm	200
2		CFM41xxx-T Product	68.58x50.8x26.5mm	100
3	G64304163	Inner Box	76x66x35 mm	100
4	G64114346	No.148 Cardboard Box	393x385x220mm	1
5	G64U10075	Partition	326x200x6 mm	3
6	G64301114	Antistatic Foam	326x200x25 mm	2
7	G64301113	Antistatic Foam	373x200x25 mm	2

Each Box Packaging 100 PCS Products
Gross weight Ref. 8Kg
Net weight Ref. 7Kg

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