AC-DC Switching Power Module
CFM61S Series
APPLICATION NOTE

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CFM61S Series

Application Note V11 March 2019

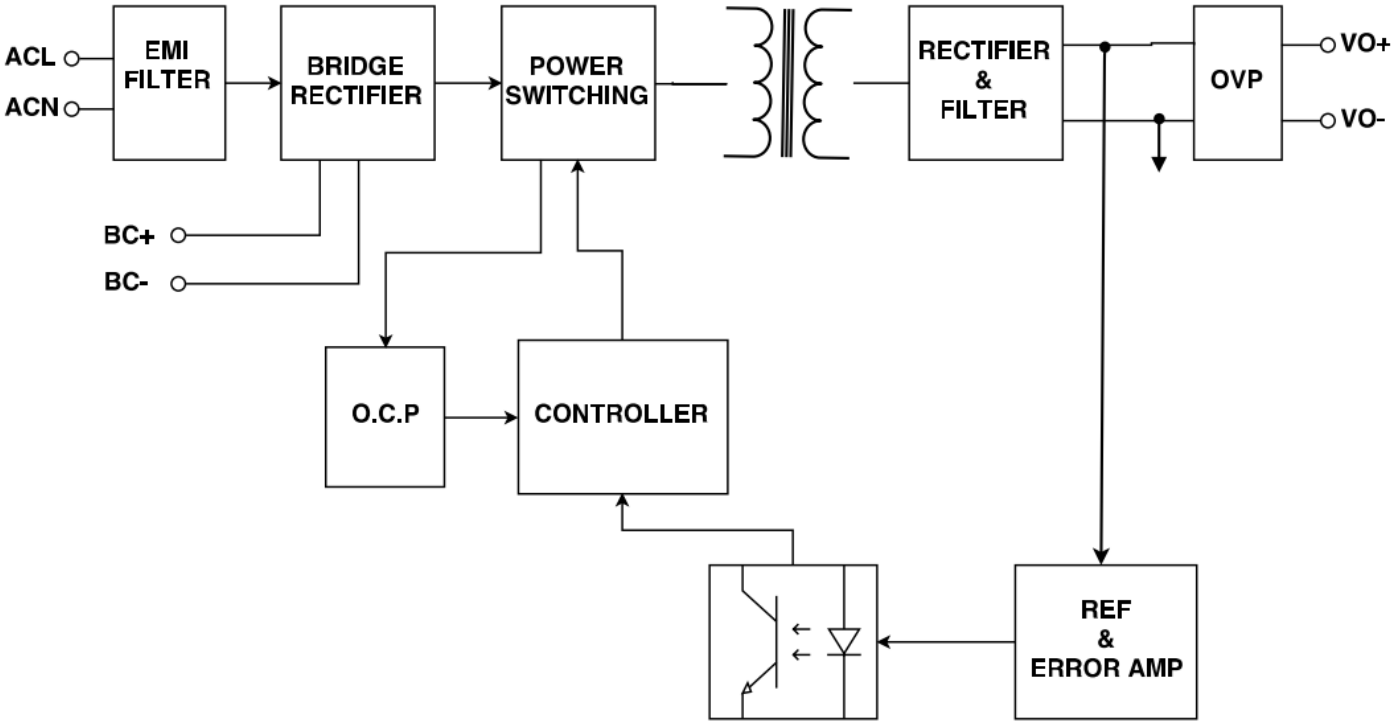
1. Introduction

This application note describes the features and functions of Cincon's CFM61S 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 CFM61S series power module is extremely reliable.

2. CFM61S Series Features

- 60W Isolated Output
- High Efficiency Up to 90%
- EN55032 Class B and CISRP/FCC Class B
- Approved IEC62368-1,UL62368-1,EN62368-1
- Continuous Short Circuit Protection
- Over Voltage Protection
- Peak Load (2 Times of Rated Current)
- No Load Input Power < 0.15W
- CLASS II

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	-30		70	℃
Storage Temperature		All	-30		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			1.5	A
Leakage Current		All			0.25	mA
Inrush Current	Vin=240Vac, cold start at 25℃.	All			120	A
OUTPUT CHARACTERISTICS						
PARAMETER	**NOTES and CONDITIONS**	Device	Min.	Typical	Max.	Units
Output Voltage Set Point	Vin=Nominal Vin, Io=Io.max, Tc=25℃.	CFM61S050	4.9	5	5.1	Vdc
		CFM61S120	11.88	12	12.12	
		CFM61S150	14.85	15	15.15	
		CFM61S240	23.76	24	24.24	
		CFM61S360	35.64	36	36.36	
		CFM61S480	47.52	48	48.48	
Operating Output Current Range		CFM61S050			8	A
		CFM61S120			5	
		CFM61S150			4	
		CFM61S240			2.5	
		CFM61S360			1.67	
		CFM61S480			1.25	
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			±1.0	%
Over Voltage Protection	uses a TVS component to clamp output voltage	CFM61S050		6.8		VDC
		CFM61S120		15		
		CFM61S150		18		
		CFM61S240		30		
		CFM61S360		47		
		CFM61S480		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. (CFM61S050: Add a 0.1uF ceramic capacitor and 47uF aluminum electrolytic capacitor to output.) 2. Oscilloscope is 20MHz band width. 3. Ambient temperature=25℃	CFM61S050 CFM61S120 CFM61S150 CFM61S240 CFM61S360 CFM61S480			50 120 150 240 360 480	mVp-p
Load Capacitance	1. Ambient temperature=25℃ 2. Input voltage is 115VAC and 230VAC 3. Output is max. load	CFM61S050 CFM61S120 CFM61S150 CFM61S240 CFM61S360 CFM61S480			8000 5000 4000 2400 1680 680	uF
Efficiency	Output is rated load Ambient temperature=25℃ @ Input voltage is 230VAC	CFM61S050 CFM61S120 CFM61S150 CFM61S240 CFM61S360 CFM61S480		86 88 88 89 89 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	300			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

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Weight		CFM61SXXX CFM61SXXX-E CFM61SXXX-T		93 190 96		g
Safety	Class II,IEC62368-1,UL62368-1,EN62368-1					
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,EN6100-6-3:2012,Class B, 47 CFR FCC Part 15 Subpart B (Class B)					
Radiated disturbance	EN55032,EN6100-6-3:2012,Class B, 47 CFR FCC Part 15 Subpart B (Class B)					
Harmonic current emissions	EN6100-3-2:2014					
Voltage fluctuations & flicker	EN6100-3-3:2013					
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,					
Radio-frequency, Continuous radiated disturbance	IEC 61000-4-3:2010					
Electrical fast transient (EFT)	IEC 61000-4-4:2012, ±0.5KV, ±1 KV, ±2 KV					
Surge	IEC 61000-4-5:2014, L-N: ±0.5kv, ±1kv,					
Conducted disturbances, induced by RF fields	IEC 61000-4-6:2013					
Power frequency magnetic field	IEC 61000-4-8:2009					
Voltage dips	IEC 61000-4-11:2004, Dip: 30% 10ms, Dip: 60% 100ms, Dip >95% 5000ms					
Voltage interruptions	IEC 61000-4-11:2004, >95% 5000ms					

5. Main Features and Functions

5.1 Operating Temperature Range

The highly efficient design of Cincon's CFM61S series power modules has resulted in their ability to operate within ambient temperature environments from -30^{0}C to 70^{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:

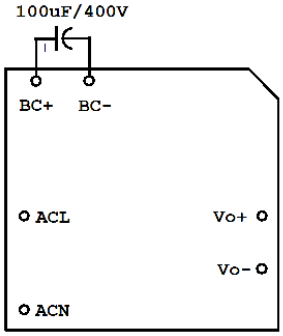
- Input voltage range
- Permissible Output load (per derating curve)

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.

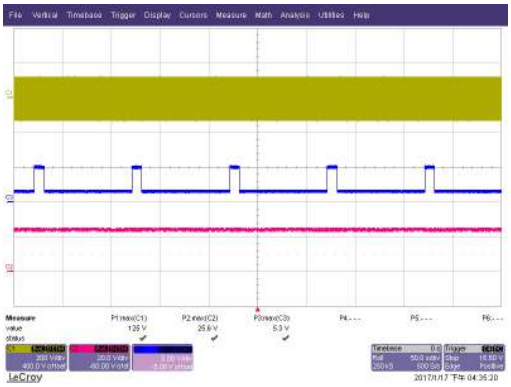
5.3 Peak Load Function

CFM61SXXX and CFM61SXXX-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 100uF/ 400V capacitor to BC+ & BC-, but this is not needed when input is @ 230Vac.



Vin=110Vac&115Vac&230Vac&264Vac

Peak Load Function by 200% Load 10S & 65% Load 90S



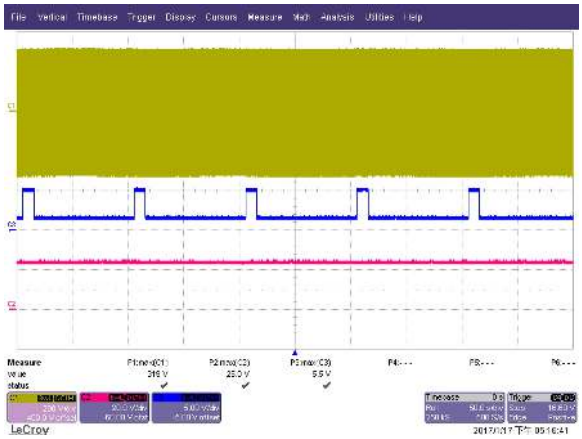
CH1:Vin CH2:Vout Current CH3:Vout

Average Power:47.1W

add external 100u / 400V capacitor to BC &+ BC-.

Vin=230Vac&264Vac

Peak Load Function by 200% Load 10S & 65% Load 90S



CH1:Vin CH2:Vout Current CH3:Vout

Average Power:47.1W

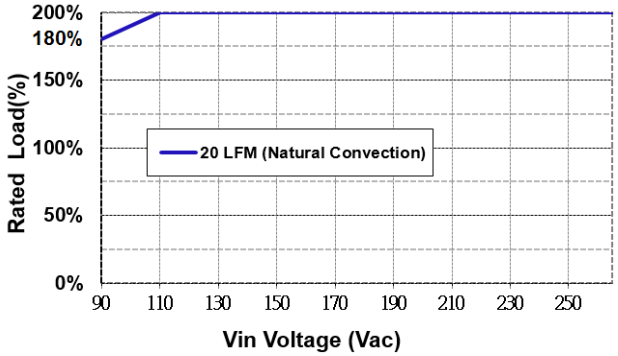
6. EMC & Safety

■ 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

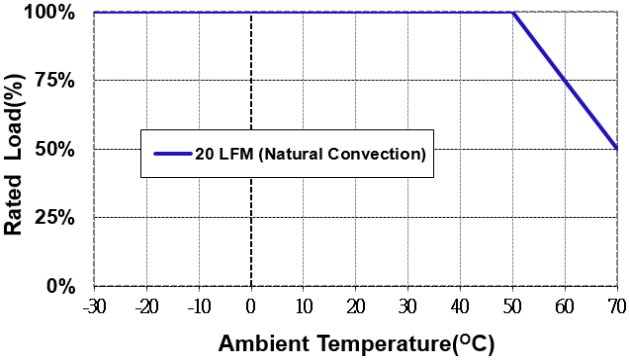
■ Safety
Class II, IEC62368-1, UL62368-1, EN62368-1

7. Applications

7.1 Peak Load Vin De-Rating Curve



7.2 Power De-Rating Curve



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 CFM61S 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.

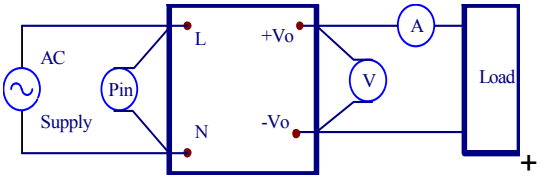


Figure 1. CFM61S Series Test Setup

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 0.1uF ceramic capacitor and a 10uF electrolytic capacitor to output at 20 MHz Band Width. (CFM61S050: Add a 0.1uF ceramic capacitor and 47uF aluminum electrolytic capacitor to output.)

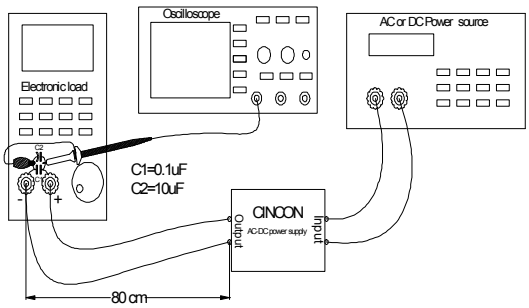
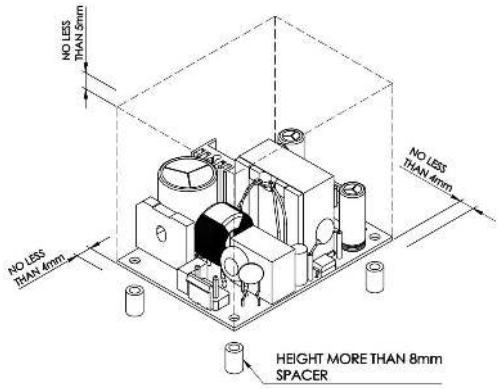


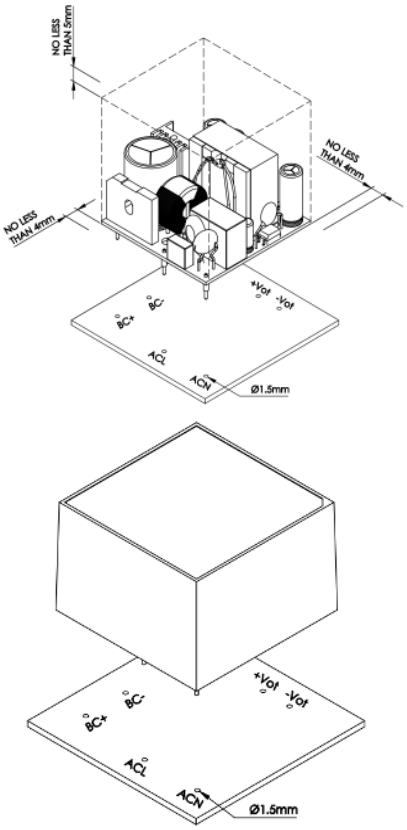
Figure 2. Output Voltage Ripple and Noise Measurement Set-Up

7.5 Installation Instruction

The CFM61SXXX-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.



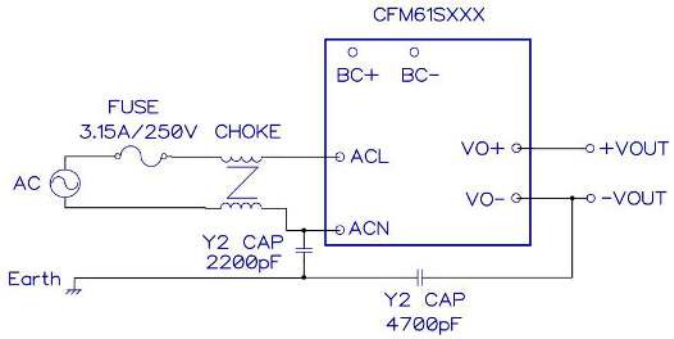
The CFM61SXXX and CFM61SXXX-E mounting holes are 1.5mm. Please allow 4mm side clearance from the components and all side of the PCB and CASE. Allow 5mm clearance above the highest parts on the PCB and CASE.



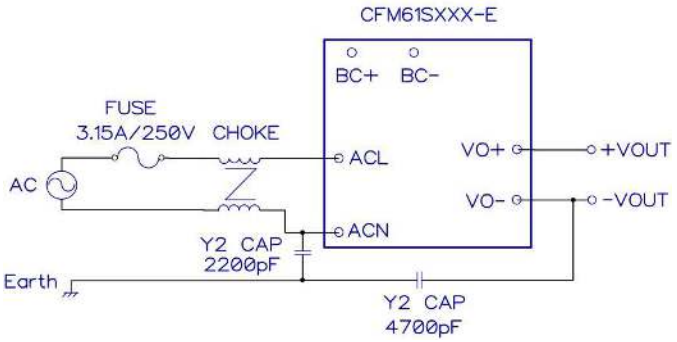
7.6 EMI Test

The CFM61S 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.

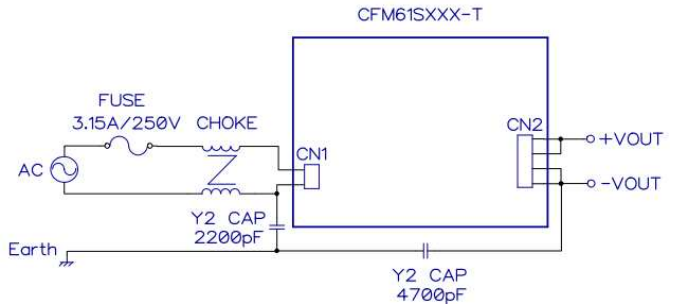
CFM61SXXX



CFM61SXXX-E



CFM61SXXX-T



Additional Inductance related parameters:

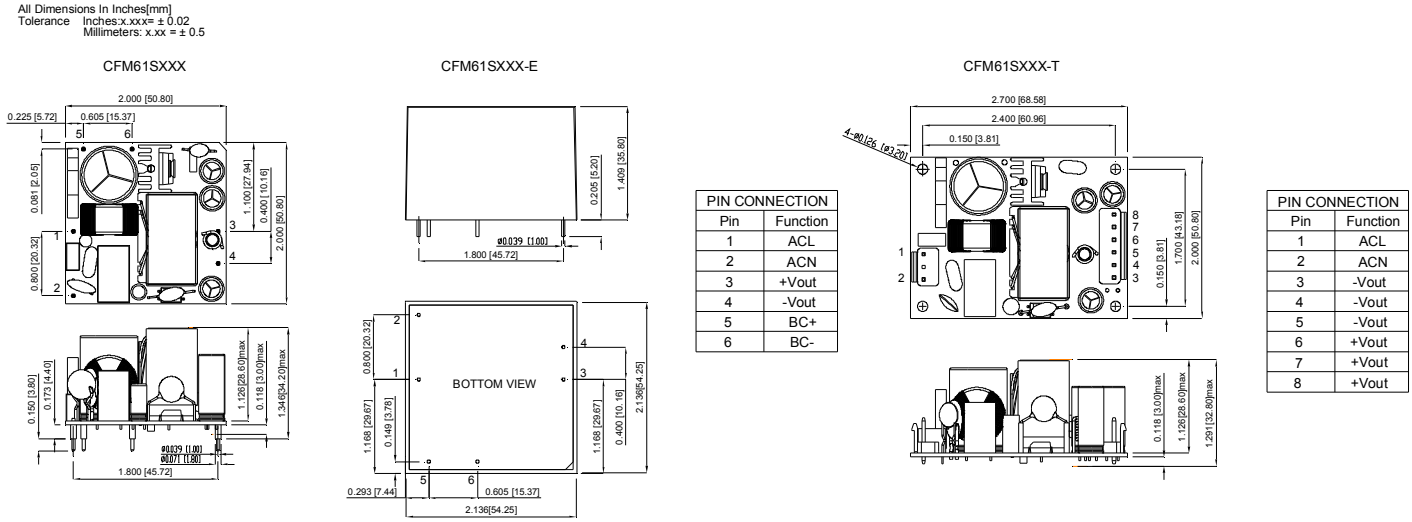
Specification	Inductance	Duplex Winding /turns	Manufacturers
T10*6*5C A15	2.6mH	TIW-M Φ0.35*2/25T	ACME
T10*6*5C R15K	2.6mH	TIW-M Φ0.35*2/25T	VAKOS

Additional Safety YCap related parameters:

Subclass	Withstand Voltage	Capacitance	Manufacturers
Y2 CAP	250V(min)	2200pF(typ.)	TDK
Y2 CAP	250V(min)	4700pF(typ.)	TDK

8. CFM61S Series Mechanical Outline Diagrams

8.1. Mechanical Outline Diagrams



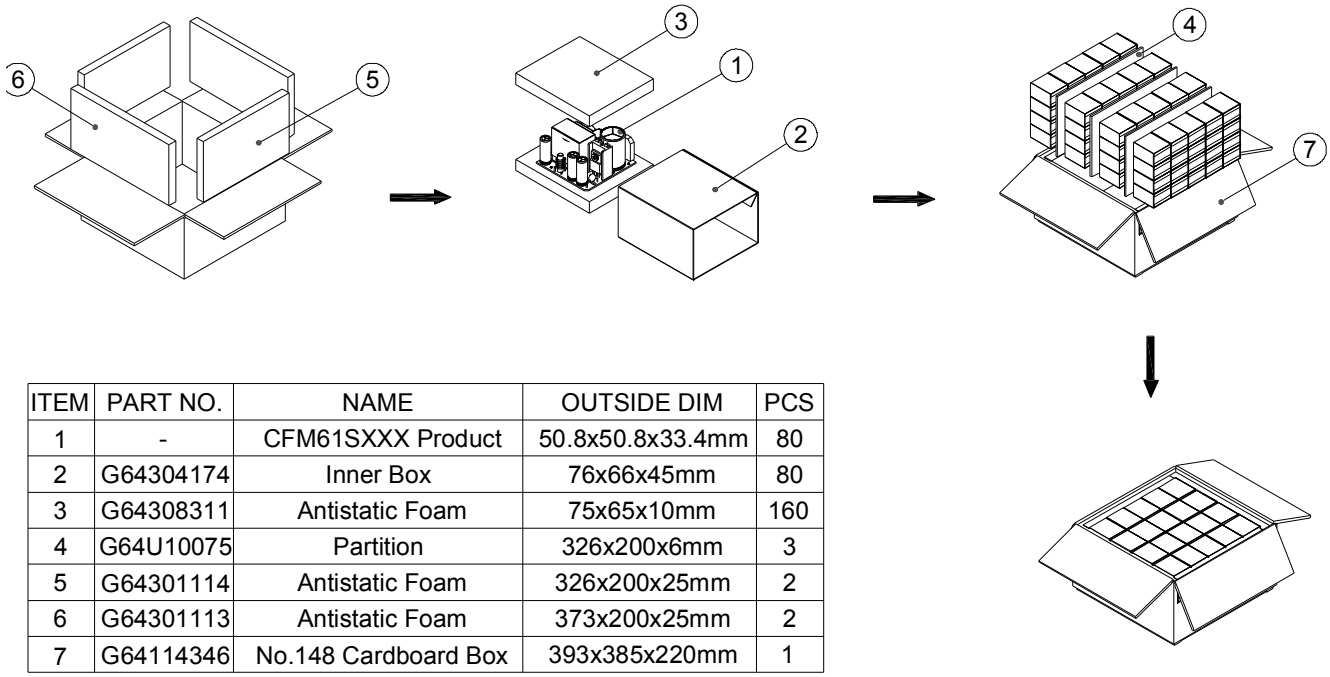
PIN CONNECTION	
Pin	Function
1	ACL
2	ACN
3	+Vout
4	-Vout
5	BC+
6	BC-

PIN CONNECTION	
Pin	Function
1	ACL
2	ACN
3	-Vout
4	-Vout
5	-Vout
6	+Vout
7	+Vout
8	+Vout

Figure 3. CFM61S series Mechanical Outline Diagram

8.2. Packing Information

The packing information for CFM61S SERIES is showing as follows:

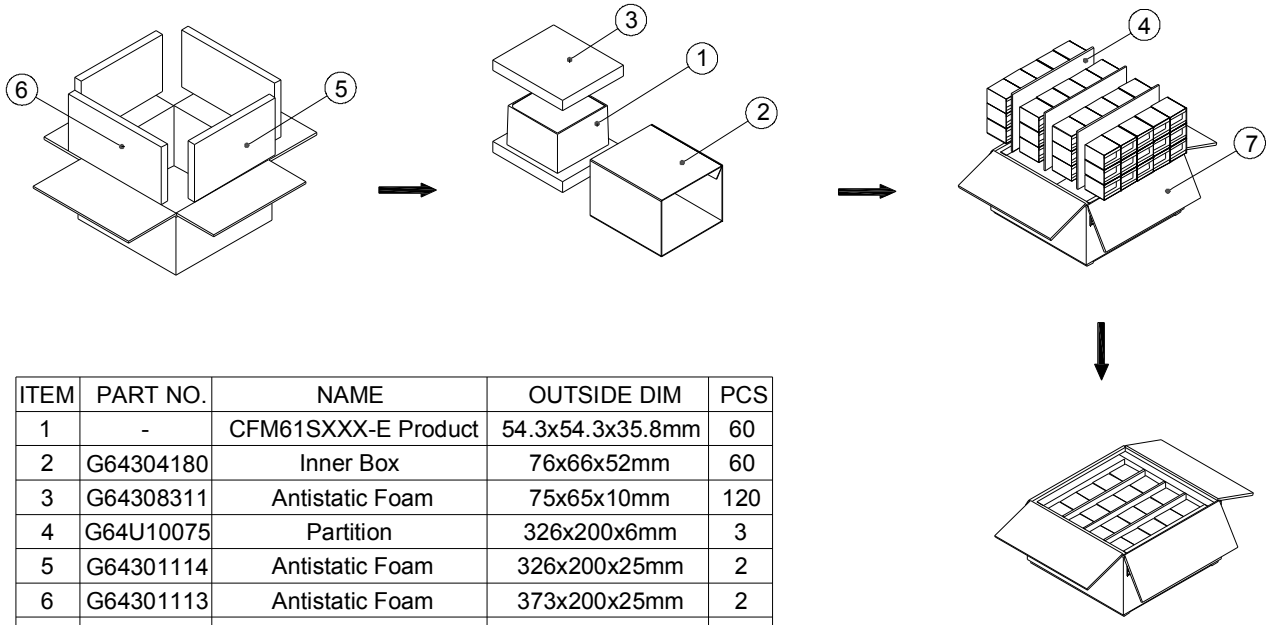


ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	-	CFM61SXXX Product	50.8x50.8x33.4mm	80
2	G64304174	Inner Box	76x66x45mm	80
3	G64308311	Antistatic Foam	75x65x10mm	160
4	G64U10075	Partition	326x200x6mm	3
5	G64301114	Antistatic Foam	326x200x25mm	2
6	G64301113	Antistatic Foam	373x200x25mm	2
7	G64114346	No.148 Cardboard Box	393x385x220mm	1

Each Box Packaging 80PCS Products
Gross weight Ref. 8.5Kg

CFM61S 80pcs a box, including the total weight of package material about 8.5Kg

The packing information for CFM61S-E SERIES is showing as follows:

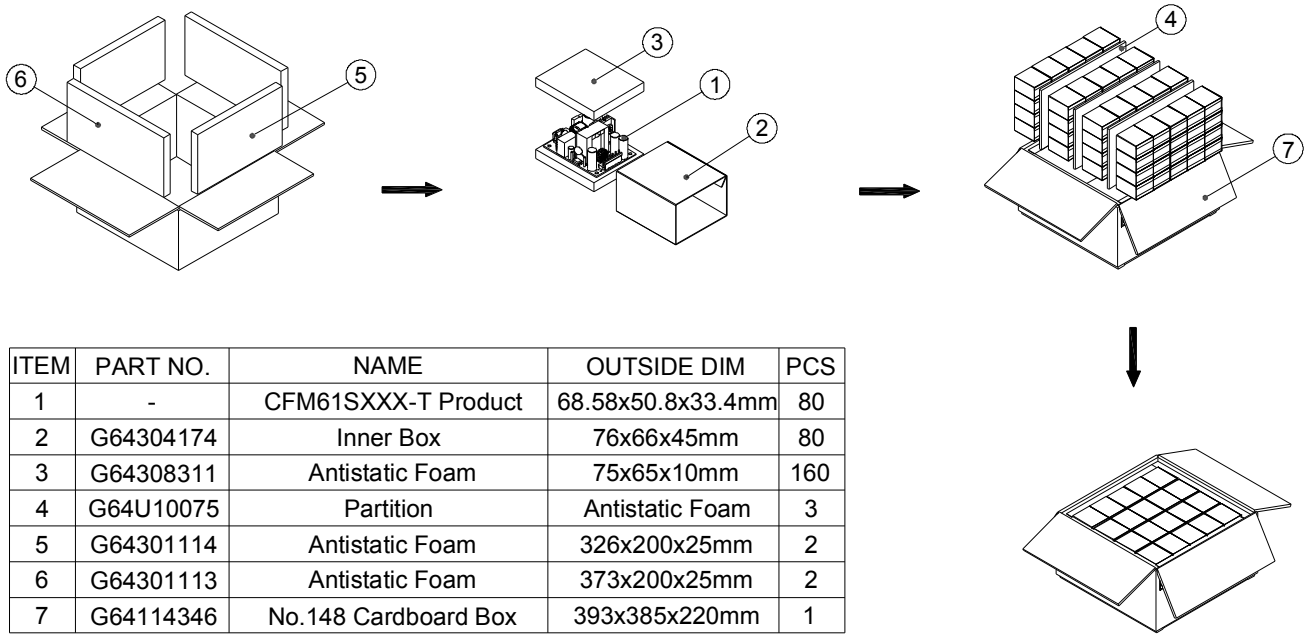


ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	-	CFM61SXXX-E Product	54.3x54.3x35.8mm	60
2	G64304180	Inner Box	76x66x52mm	60
3	G64308311	Antistatic Foam	75x65x10mm	120
4	G64U10075	Partition	326x200x6mm	3
5	G64301114	Antistatic Foam	326x200x25mm	2
6	G64301113	Antistatic Foam	373x200x25mm	2
7	G64114346	No.148 Cardboard Box	393x385x220mm	1

Each Box Packaging 60PCS Products
Gross weight Ref. 13Kg

CFM61S-E 60pcs a box, including the total weight of package material about 13Kg

The packing information for CFM61S-T SERIES is showing as follows:



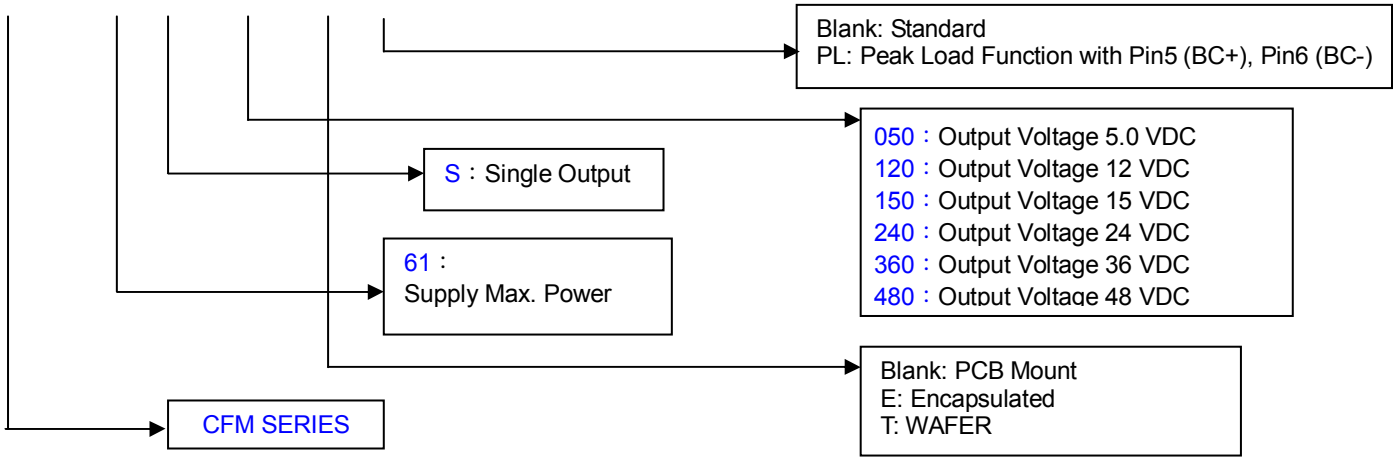
ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	-	CFM61SXXX-T Product	68.58x50.8x33.4mm	80
2	G64304174	Inner Box	76x66x45mm	80
3	G64308311	Antistatic Foam	75x65x10mm	160
4	G64U10075	Partition	Antistatic Foam	3
5	G64301114	Antistatic Foam	326x200x25mm	2
6	G64301113	Antistatic Foam	373x200x25mm	2
7	G64114346	No.148 Cardboard Box	393x385x220mm	1

Each Box Packaging 80PCS Products
Gross weight Ref. 9Kg

CFM61S-T 80pcs a box, including the total weight of package material about 9Kg

9. Part Number

CFM XX S XXX-X YZ



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