CFM12S SERIES
12 WATT OPEN FRAME AC-DC MODULES

Features

- Universal Input Range 90~264Vac
- High Efficiency up to 87%
- 1.5"x 1" Open Frame Compact Size
- Class II
- No Load Input Power < 75mW
- Approval IEC/EN/UL 62368-1
- Approval IEC/EN 60335-1
- Approval EN 55032 Class B and CISPR/FCC Class B
- Operating Altitude 5000m
- Continuous Short Circuit Protection
- Over Voltage Protection

MODEL NUMBER	OUTPUT VOLTAGE	OUTPUT CURRENT	VOLTAGE ACCURACY NOTE1	RIPPLE& NOISE NOTE2	LINE REGULATION NOTE3	LOAD REGULATION NOTE4	%EFF. (Typ.) NOTE5
CFM12S050	5 V	2 A	±2%	100mV	±1%	±1%	80%
CFM12S090	9 V	1.34 A	±2%	100mV	±1%	±1%	85%
CFM12S120	12 V	1.0 A	±2%	120mV	±1%	±1%	85%
CFM12S150	15 V	0.8 A	±2%	150mV	±1%	±1%	85%
CFM12S240	24 V	0.5 A	±2%	240mV	±1%	±1%	87%

Note:

1. Voltage accuracy is set at 100% full load.
2. Add a 0.1uF ceramic capacitor and a 10uF E.L. capacitor to output for ripple & noise measurement @20MHz BW.
3. Line regulation is measured from $90V_{ac}$ to $264V_{ac}$ with 100% full load.
4. Load regulation is measured from 10% to 100% full load.
5. Typical efficiency at 230 V_{ac} and 100% full load at 25℃.
6. T Version wafer with JST B3B-XH/B4B-XH and mate with JST housing XH series or equivalent.
7. L Version & EL Version Safety only approved only IEC/EN 60335-1.

PART NUMBER

Series	Number of Outputs	Nominal Output Voltage	Type
CFM12	X	XXX	-XX
CFM12	S: Single	050: 5V 090: 9V 120: 12V 150: 15V 240: 24V	Blank: PCB Mount E: Encapsulated T: Wafer L: Lead Wire EL: Encapsulated & Lead Wire

Part Number Example:

CFM12S120-T: Open Frame, 12W, Single 12Vdc Output, Wafer

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.	Typ.	Max.	Units
Input Voltage	Safety approvals only to the AC input	All	90 120		264 370	V_{ac} V_{dc}
Operating Case Temperature	See Derating Curve	All	-40		75	℃
Storage Temperature		All	-40		85	℃
Operating Altitude	IEC/EN/UL 62368-1 IEC/EN 60335-1	All			5000	m

INPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Operating Voltage Range		All	100		240	V_{ac}
Input Frequency Range		All	50		60	Hz
Maximum Input Current	100% Load, V_{in}=100V_{ac}	All			0.4	A
Leakage Current		All			0.25	mA
Inrush Current	V_{in}=240V_{ac}, Cold start at 25℃	All			50	A

OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Output Voltage Set Point	V_{in}=Nominal V_{in}, I_o=Io max., T_c=25℃	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240	4.90 8.82 1176 14.70 23.52	5 9 12 15 24	5.10 9.18 12.24 15.30 24.48	V_{dc}
Operating Output Current Range	V_{in}=90V_{ac}~264V_{ac}, See Derating Curve	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240			2.0 1.34 1.0 0.8 0.5	A
Holdup Time	V_{in}=115V_{ac}	All		10		ms
Output Voltage Regulation						
Load Regulation	10% Load to full load	All			±1.0	%
Line Regulation	V_{in}=High Line to low line	All			±1.0	%
Over Voltage Protection	Hiccup mode (Auto recovery)	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240			6.3 12.6 15.8 18.9 31.5	V_{dc}
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℃	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240			100 100 120 150 240	mV
Load Capacitance	1. V_{in}=115V_{ac} and 230V_{ac} 2. Output is max. load 3. Ambient temperature=25℃	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240			2000 1340 1000 800 500	uF

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Efficiency	1. Output is rated load 2. Ambient temperature=25℃ 3. Input voltage is 230V_{ac}	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240		80 85 85 85 87		%

ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Input to Output	1 minute	All			3000	V_{ac}
Isolation Resistance	Input to output	All	100			MΩ

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Switching Frequency	Pout=max. rated power	All		65		kHz

GENERAL SPECIFICATIONS

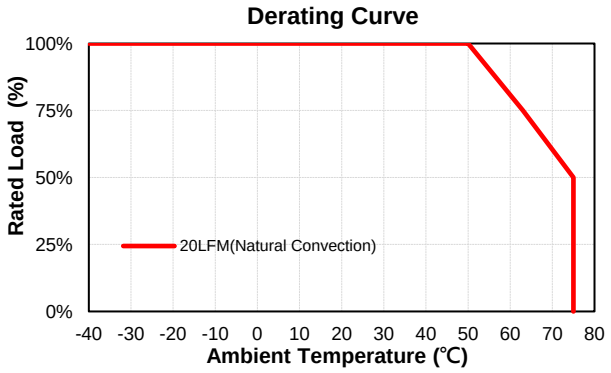
PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
MTBF	I_o=100%; T_a=25℃ per MIL-HDBK-217F	All	580			k hours
Humidity	Non-condensing	All			93	% RH
Shock	Meet MIL-STD-810F Table 516.5,Table 516.5-I 10ms, each axis 3 times(±X、±Y、±Z axis)	All		75		g
Vibration	Meet MIL-STD-810F Table 514.5C-VIII,15~2000Hz, X、Y、Z axis, 1 hour (each axis),. Total 3 hrs.	All		4		g
Weight		CFM12S CFM12S-E CFM12S-T CFM12S-L CFM12S-EL		16 40 17 21 45		grams
Dimensions	Blank (PCB mount)	All	1.500x1.000x0.756 Inches (38.10x25.40x19.20 mm)			
	E (Encapsulated)	All	1.600x1.100x0.772 Inches (40.64x27.94x19.60mm)			
	T (Wafer)	All	2.150x1.000x0.689 Inches (54.61x25.40x17.50mm)			
	L (Lead wire)	All	1.500x1.000x0.681 Inches (38.10x25.40x17.30mm)			
	EL (Encapsulated & Lead wire)	All	1.600x1.100x0.772 Inches (40.64x27.94x19.60mm)			
Safety	Class II, IEC/EN/UL 62368-1, IEC/UL 60950-1, IEC/EN 60335-1 L Version & EL Version Safety only approved only IEC/EN 60335-1					
EMC Emission	EN 55032, EN 61000-3-2, EN 6100-3-3, EN 61000-6-3, Class B. EN 61000-6-4 47 CFR FCC Part 15 Subpart B (Class B)					Class B
Conducted Disturbance	EN 55032 2015, EN 6100-6-3 2007+A1: 2011+AC: 2012, Class B. EN 61000-6-4 47 CFR FCC Part 15 Subpart B (Class B)					Class B
Radiated Disturbance	EN 55032 2015, EN 6100-6-3 2007+A1: 2011+AC: 2012, Class B. EN 61000-6-4 47 CFR FCC Part 15 Subpart B (Class B)					Class B
Harmonic Current Emissions	EN 61000-3-2:2014					
Voltage Fluctuations & Flicker	EN 61000-3-3:2013					
EMC Immunity	EN 55024 2010+A1:2015, EN 61204-3:2000, EN 61000-6-1:2007, EN 61000-6-2:2005					
Electrostatic Discharge (ESD)	IEC 61000-4-2:2008, Air Discharge: ±8kV, Contact Discharge: ±4kV					Criterion B
Radio-Frequency, Continuous Radiated Disturbance	IEC 61000-4-3:2010					Criterion A
Electrical Fast Transient (EFT)	IEC61000-4-4:2012, ±1kV, ±2kV					Criterion B
Surge	IEC61000-4-5:2014, L-N: ±1kV					Criterion B
Conducted Disturbances, Induced by RF Fields	IEC 61000-4-6:2013					Criterion A

GENERAL SPECIFICATIONS

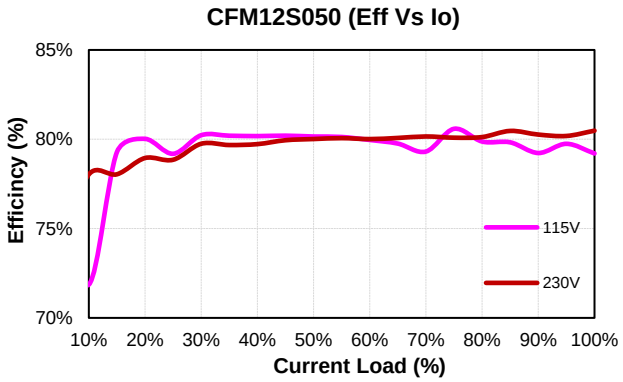
Power Frequency Magnetic Field	IEC 61000-4-8:2009	Criterion A
Voltage Dips	IEC 61000-4-11:2004, Dip: 30% Reduction, Dip >95% Reduction	Criterion C
Voltage Interruptions	IEC 61000-4-11:2004, >95% Reduction	Criterion C
Application Note Link		CFM12S Series App Notes

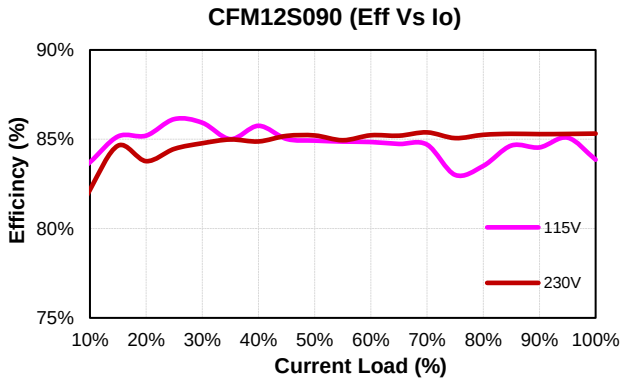
CHARACTERISTIC CURVE

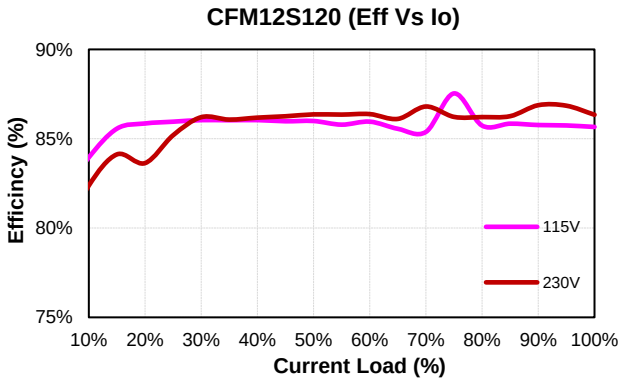
Power Derating Curve

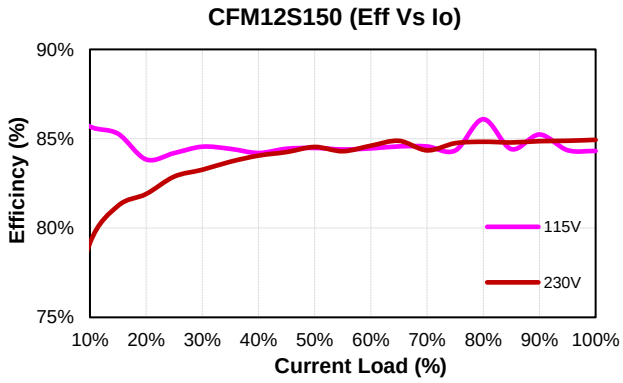


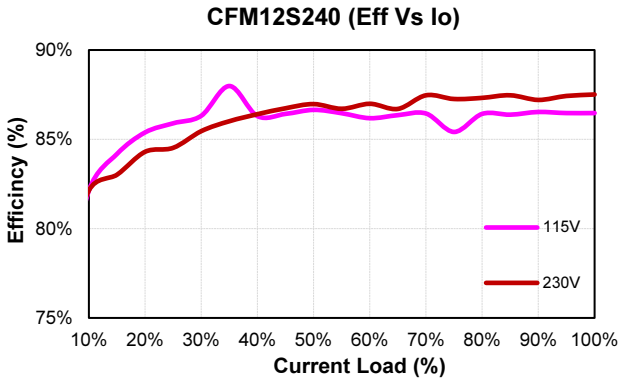
Performance Data





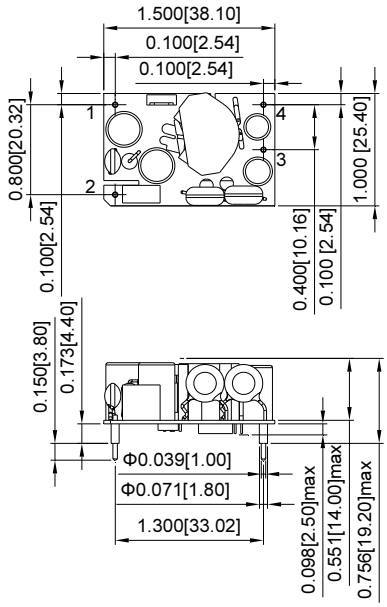




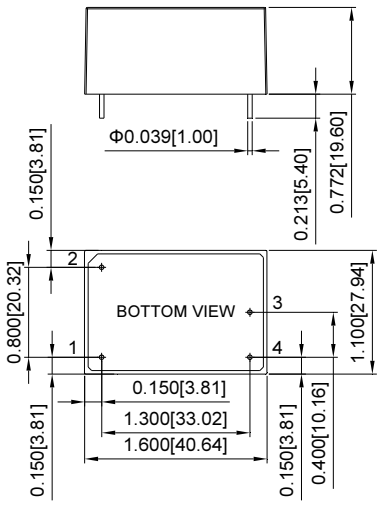


MECHANICAL SPECIFICATION

CFM12SXXX



CFM12SXXX-E

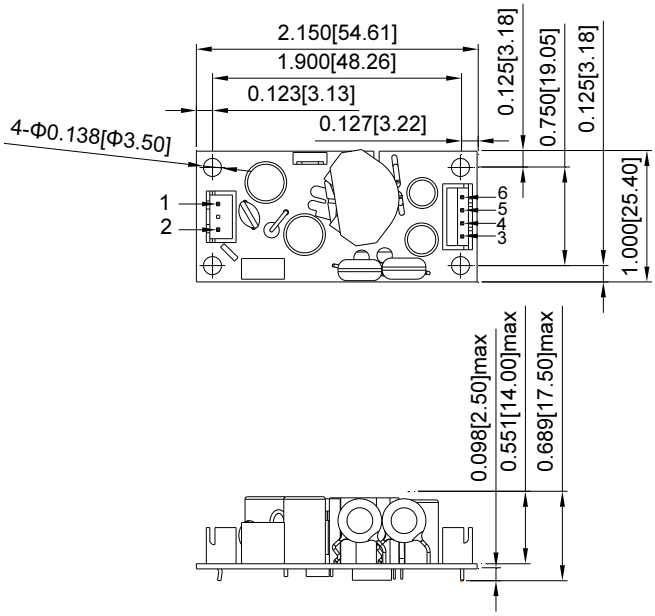


PIN CONNECTION

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

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

CFM12SXXX-T

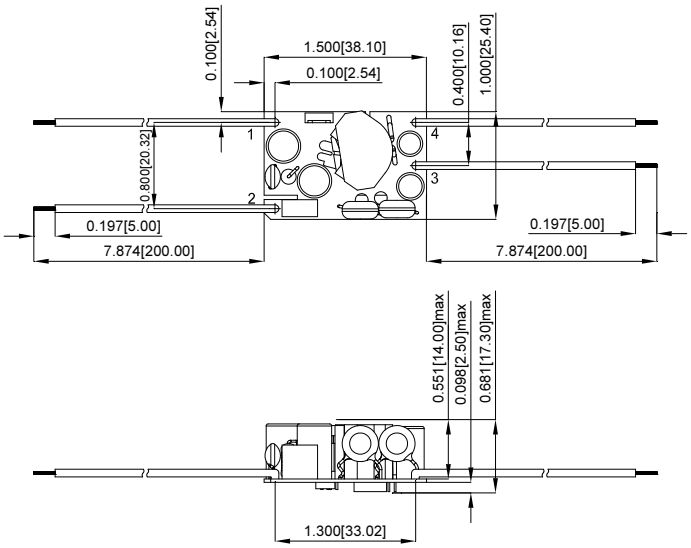


PIN CONNECTION

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

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

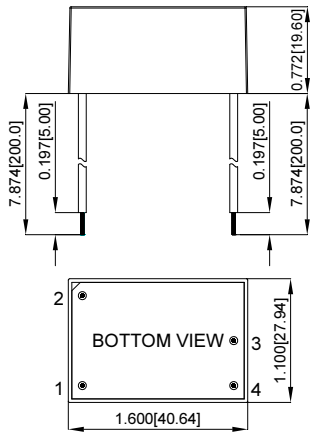
CFM12SXXX-L



CONNECTION	
Pin	Function
1 (Blue)	ACN
2 (Brown)	ACL
3 (Black)	-Vout
4 (Red)	+Vout

Cable: 20AWG/UL 1007, Φ1.8 ± 0.2mm
All Dimensions In Inches[mm]
Tolerance Inches:x.xxx= ± 0.02
Millimeters: x.xx = ± 0.5

CFM12SXXX-EL



CONNECTION	
Pin	Function
1 (Blue)	ACN
2 (Brown)	ACL
3 (Black)	-Vout
4 (Red)	+Vout

Cable: 20AWG/UL 1007, Φ1.8 ± 0.2mm
All Dimensions In Inches[mm]
Tolerance Inches:x.xxx= ± 0.02
Millimeters: x.xx = ± 0.5

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AC-DC Switching Power Module
CFM12S Series
APPLICATION NOTE

Approved By:

Department	Approved By	Checked By	Written By
Research and Development Department	Enoch	Yang/Su Shih Hang Ovid	Joyce
Quality Assurance Department	Ryan	Benny	

CFM12S Series

Application Note V15 July 2020

Content

CFM12S Series

Application Note V15 July 2020

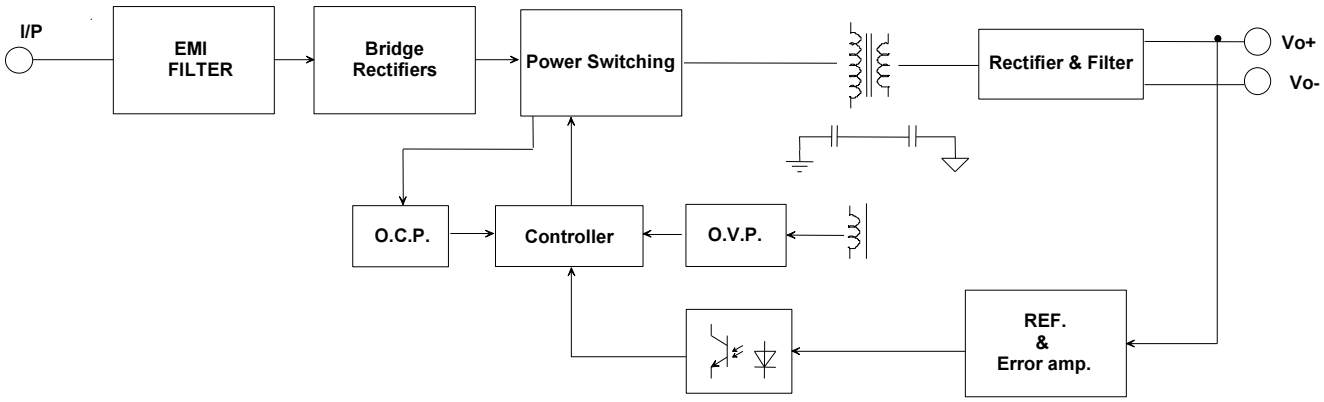
1. Introduction

This application note describes the features and functions of Cincon's CFM12S 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 CFM12S series power module is extremely reliable.

2. CFM12S Series Features

- Universal Input 90~264VAC
- High Efficiency Up to 87%
- Approved EN55032 Class B and CISPR/FCC Class B
- Approved IEC62368-1, UL62368-1, EN62368-1
- Meets EN60335-1
- Continuous Short Circuit Protection
- Over Voltage Protection
- No Load Input Power < 75mW
- 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	90 120		264 370	Vac Vdc
Operating Temperature	See derating curve	All	-40		75	℃
Storage Temperature		All	-40		85	℃
Input/Output Isolation Voltage	1 minute	All	3000			Vac
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			0.4	A
Leakage Current		All			0.25	mA
Inrush Current	Vin=240Vac, cold start at 25℃.	All			50	A

OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Set Point	Vin=Nominal Vin, Io=Io.max, Tc=25℃.	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240	4.9 8.82 11.76 14.7 23.52	5 9 12 15 24	5.1 9.18 12.24 15.3 24.48	Vdc
Operating Output Current Range		CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240			2 1.34 1.0 0.8 0.5	A
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		CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240			6.3 12.6 15.8 18.9 31.5	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℃	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240			100 100 120 150 240	mVp-p

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Load Capacitance	1. Ambient temperature=25℃ 2. Input voltage is 115VAC and 230VAC 3. Output is max. load	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240			2000 1340 1000 800 500	uF
Efficiency	Efficiency measured at 100% load and input voltage is 230Vac.	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240		80 85 85 85 87		%

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	CFM12S050 CFM12S090 CFM12S120 CFM12S150 CFM12S240		580 870 660 740 620		K hours
Humidity	Nom-condensing	All			93	% RH
Shock	Meets MIL-STD-810F Table 516.5,TABLE 516.5-1 10ms, each axis 3 times(+-X、Y、Z axis)	All		75		g
Vibration	Meets MIL-STD-810F Table 514.5C-VIII,15~2000Hz, X、Y、Z axis,1 hr(each axis),. toal 3 hrs.	All		4		g
Weight		CFM12SXXX CFM12SXXX-E CFM12SXXX-T		16 40 17		g
Safety	Class II, IEC62368-1, UL62368-1, EN62368-1, IEC60950-1, UL60950-1					
EMC Emission	EN55032, EN61000-3-2, EN6100-3-3, EN61000-6-3, Class B. EN61000-6-4. 47 CFR FCC Part 15 Subpart B (Class B)					
Conducted disturbance	EN55032 2015, EN6100-6-3 2007+A1: 2011+AC: 2012, Class B. EN61000-6-4. 47 CFR FCC Part 15 Subpart B (Class B)					
Radiated disturbance	EN55032 2015, EN6100-6-3 2007+A1: 2011+AC: 2012, Class B. EN61000-6-4. 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 2010+A1:2015, EN61204-3:2000, EN61000-6-1:2007, EN61000-6-2:2005					
Electrostatic discharge (ESD)	IEC 61000-4-2:2008					Criteria B

GENERAL SPECIFICATIONS

Radio-frequency, Continuous radiated disturbance	IEC 61000-4-3:2010	Criteria A
Electrical fast transient (EFT)	IEC 61000-4-4:2012	Criteria B
Surge	IEC 61000-4-5:2014	Criteria B
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	Criteria C
Voltage interruptions	IEC 61000-4-11:2004	Criteria C

5. Main Features and Functions

5.1 Operating Temperature Range

The highly efficient design of Cincon's CFM12S series power modules has resulted in their ability to operate within ambient temperature environments from -40℃ to 75℃. 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.

6. EMC & Safety

■ Emission and Immunity

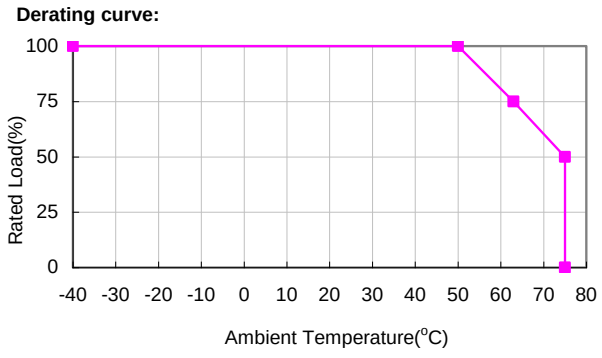
EN55032 Class B, EN55024, EN61204-3,
EN61000-3-2, EN6100-3-3,
EN61000-6-1, 2, 3, 4
47 CFR FCC Part 15 Subpart B (Class B)

■ Safety

Class II, IEC62368-1, UL62368-1, EN62368-1, IEC60950-1
UL60950-1

7. Applications

7.1 Power De-Rating Curve



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 CFM12S 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.

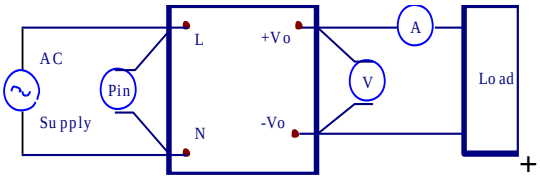


Figure 1. CFM12S Series Test Setup

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 0.1 uF ceramic capacitor and a 10 uF electrolytic capacitor to output at 20 MHz Band Width.

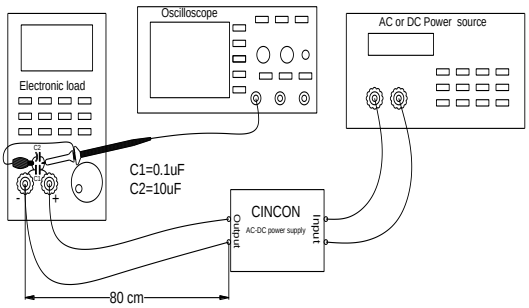
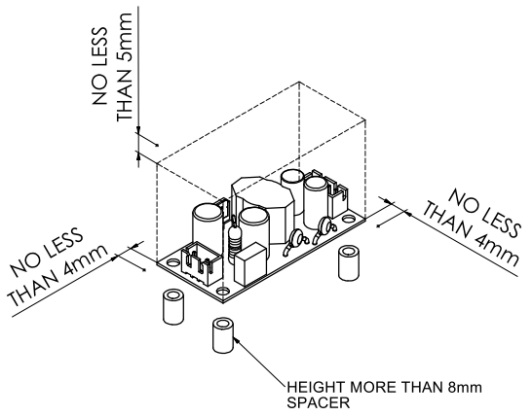


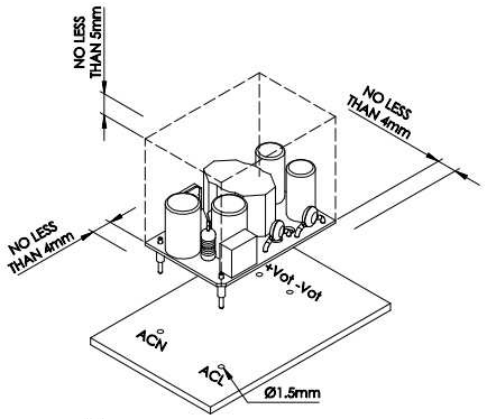
Figure 2. Output Voltage Ripple and Noise Measurement Set-Up

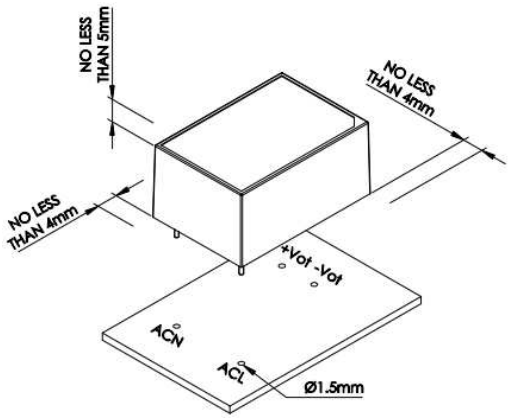
7.4 Installation Instruction

The CFM12SXXX-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 CFM12SXXX and CFM12SXXX-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.

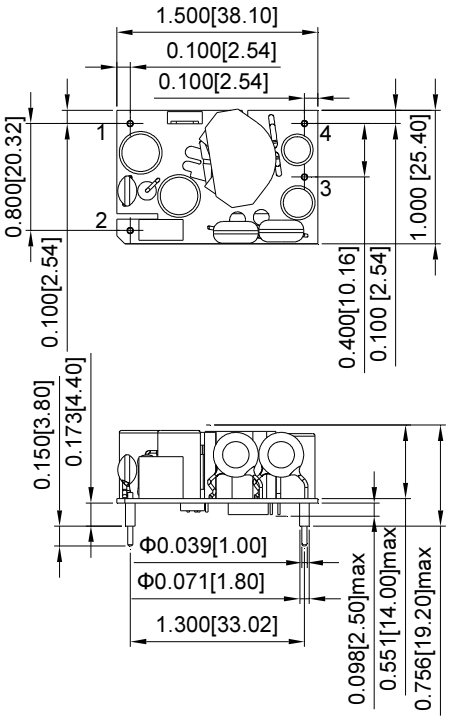




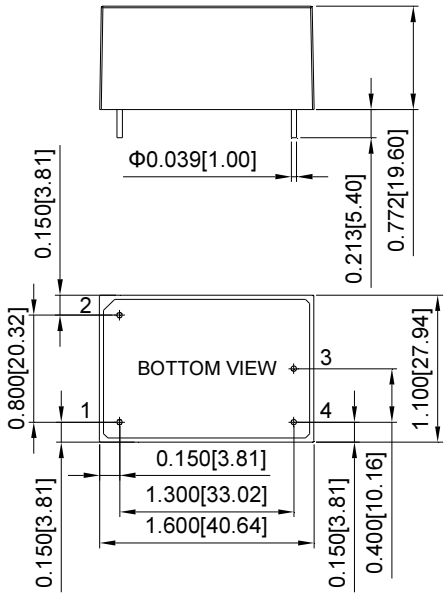
8. CFM12S Series Mechanical Outline Diagrams

8.1. Mechanical Outline Diagrams

CFM12SXXX



CFM12SXXX-E

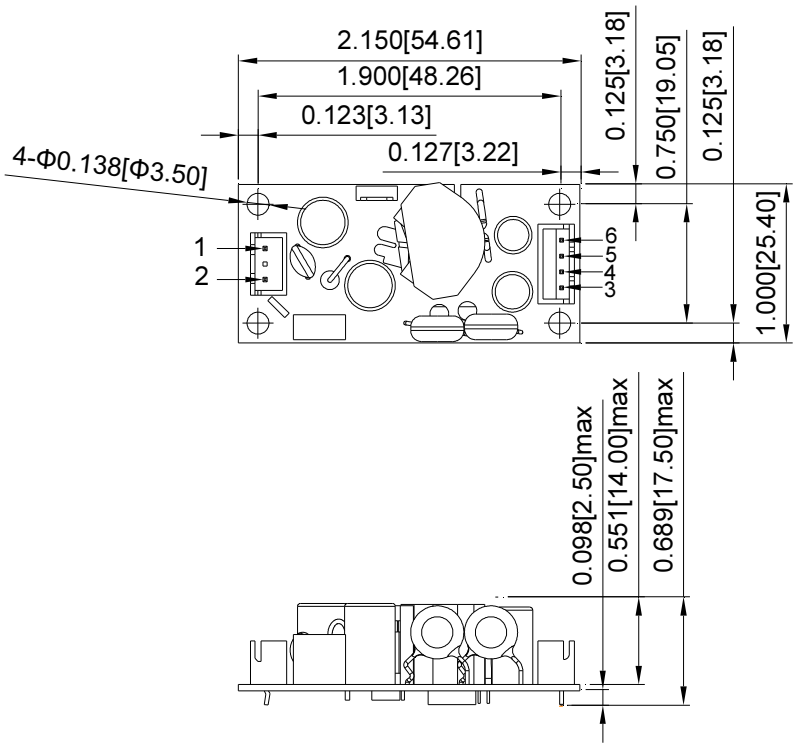


PIN CONNECTION

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

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

CFM12SXXX-T



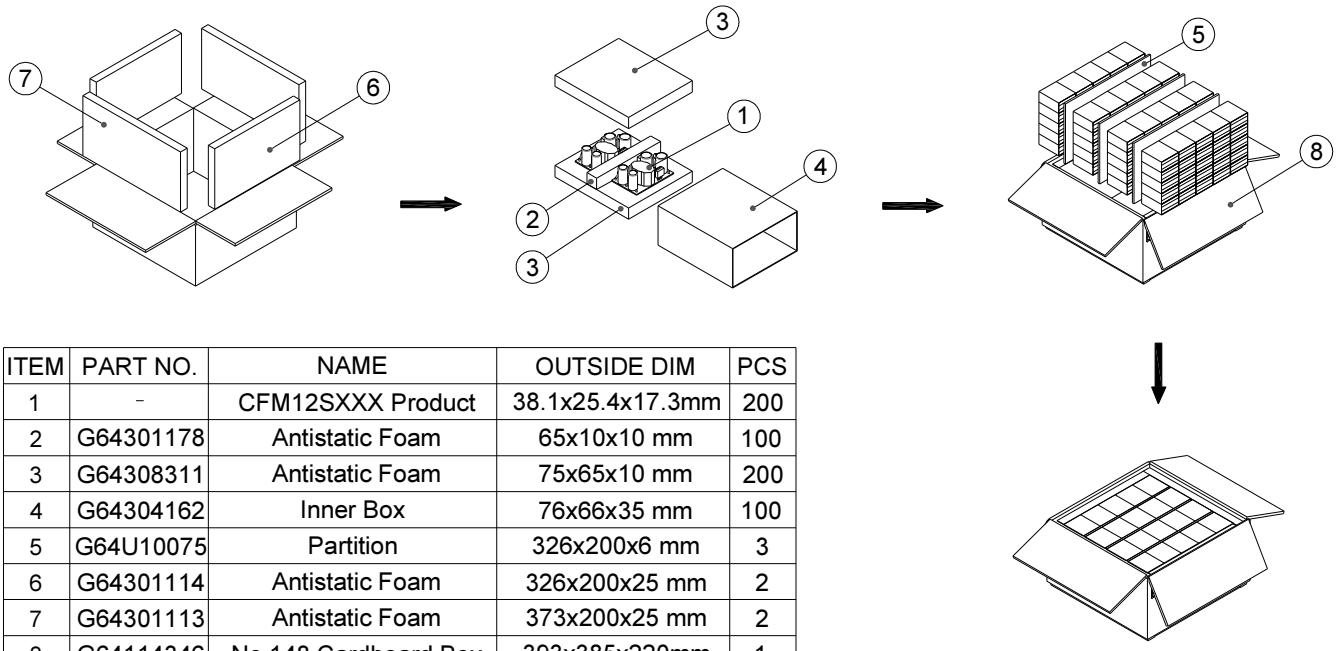
PIN CONNECTION

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

Figure 3. CFM12S series Mechanical Outline Diagram

8.2. Packing Information

The packing information for CFM12SXXX series is showing as follows:



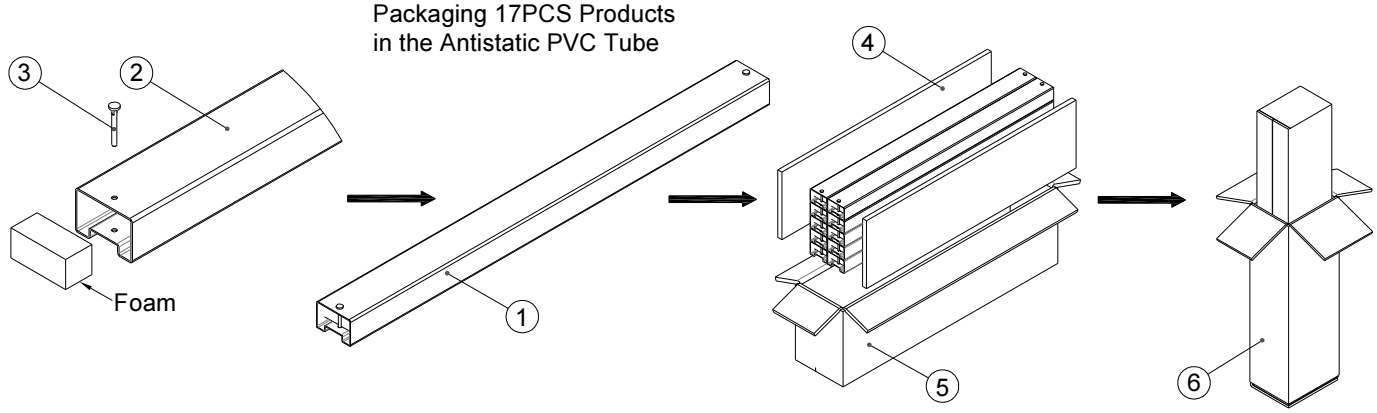
ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	-	CFM12SXXX Product	38.1x25.4x17.3mm	200
2	G64301178	Antistatic Foam	65x10x10 mm	100
3	G64308311	Antistatic Foam	75x65x10 mm	200
4	G64304162	Inner Box	76x66x35 mm	100
5	G64U10075	Partition	326x200x6 mm	3
6	G64301114	Antistatic Foam	326x200x25 mm	2
7	G64301113	Antistatic Foam	373x200x25 mm	2
8	G64114346	No.148 Cardboard Box	393x385x220mm	1

Each Box Packaging 200PCS Products
Gross weight Ref. 4.5kg

CFM12SXXX 200pcs a box, including the total weight of package material about 4.5Kg

The packing information for CFM12SXXX-E series is showing as follows:

Packaging 17PCS Products
in the Antistatic PVC Tube

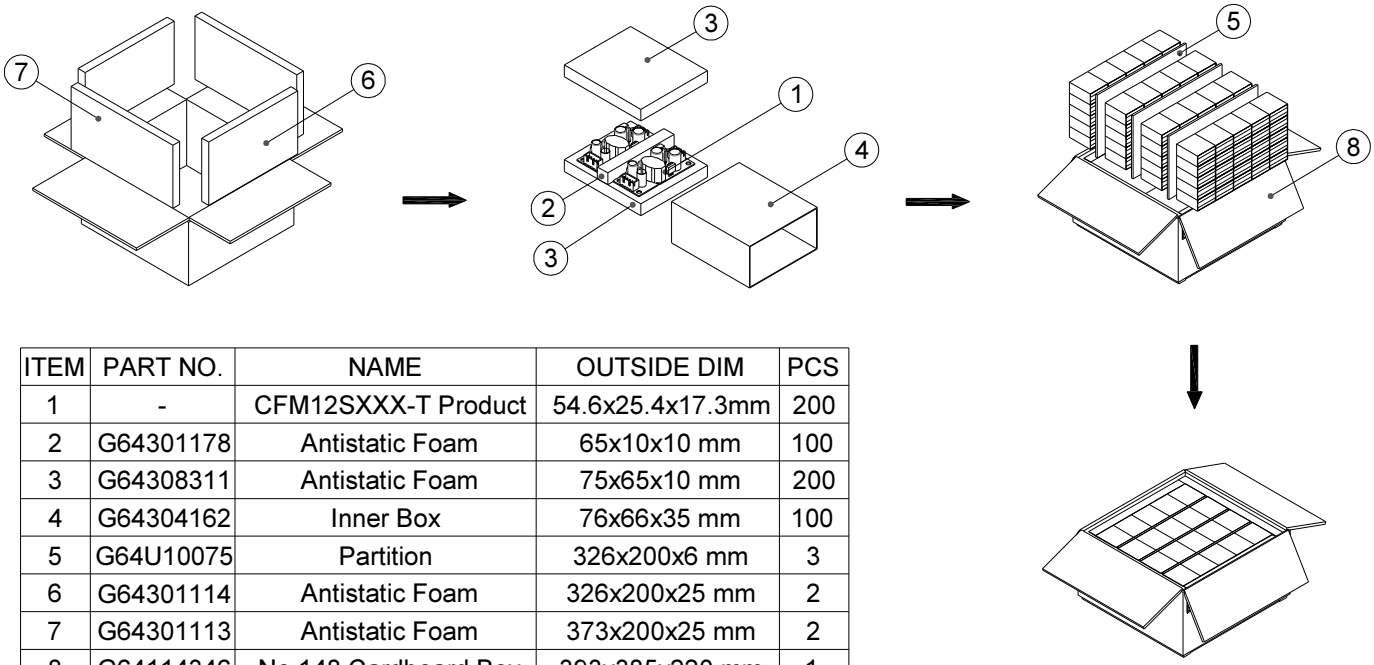


ITEM	PART NO.	NAME	OUTSIDE DIM(mm)	PCS
1	-	CFM12SXXX-E Product	40.64*27.94*19.6	170
2	G64910942	Antistatic PVC Tube	43.6*29.1*535	10
3	-	Tube Nail	-	20
4	G64301154	Antistatic Foam	535*150*10	2
5	G64203214	No.14 Inner Cardboard Box	548.4*121.2*166.7	1
6	G64112338	No.14 Cardboard Box	590.9*148.5*193.9	1

Each Box Packaging 170PCS Products
Gross weight Ref. 9.0Kg

CFM12SXXX-E 170pcs a box, including the total weight of package material about 9.0Kg

The packing information for CFM12SXXX-T series is showing as follows:



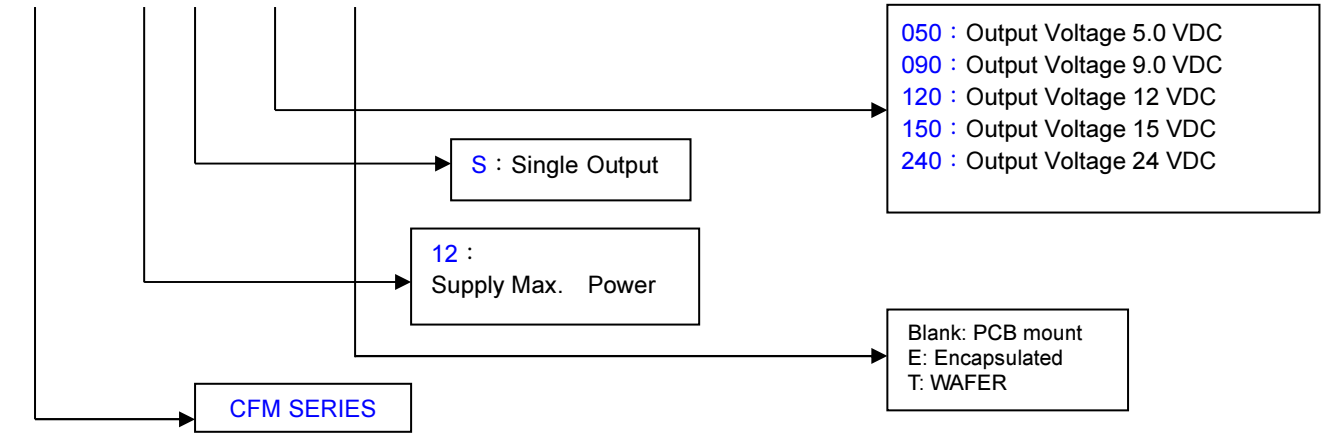
ITEM	PART NO.	NAME	OUTSIDE DIM	PCS
1	-	CFM12SXXX-T Product	54.6x25.4x17.3mm	200
2	G64301178	Antistatic Foam	65x10x10 mm	100
3	G64308311	Antistatic Foam	75x65x10 mm	200
4	G64304162	Inner Box	76x66x35 mm	100
5	G64U10075	Partition	326x200x6 mm	3
6	G64301114	Antistatic Foam	326x200x25 mm	2
7	G64301113	Antistatic Foam	373x200x25 mm	2
8	G64114346	No.148 Cardboard Box	393x385x220 mm	1

Each Box Packaging 200PCS Products
Gross weight Ref. 4.5Kg

CFM12SXXX-T 200pcs a box, including the total weight of package material about 4.5Kg

9. Part Number

CFM XX S XXX-X



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