AC-DC Switching Power Module
CBM100S Series
APPLICATION NOTE

Approved By:

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CBM100S Series

Application Note V11 March 2019

Content

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1. Introduction

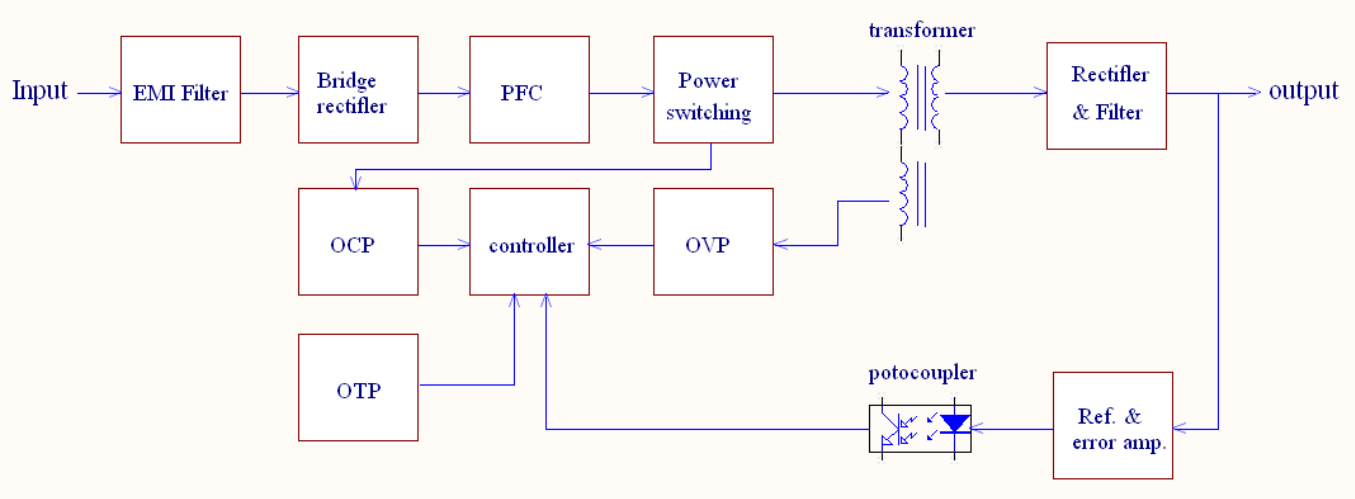
This application note describes the features and functions of Cincon's CBM100S series, the switching AC-DC power module. The CBM100S series with single output AC/DC power modules are highly efficient, reliable, compact, and highly power-density. The module is fully protected against short-circuit and over-voltage conditions.

Cincon's world-class automated manufacturing methods, extensive test and qualified program, ensure that the CBM100S series power module is extremely reliable.

2. CBM100S Series Features

- Universal Input Range 90 ~ 264Vac
- Full Load with Baseplate Cooled and no Fan Required
- Wide Operating Temperature Range
- 17mm Ultra Low Profile Package
- Safety Meets EN60950-1
- Built-in EN55032 Class B Filter
- Active PFC Meets EN61000-3-2
- High Efficiency Up to 91% Typical
- No Load Input Power Consumption <0.5W
- Over Temperature Protection
- Over Voltage Protection
- Over Current Protection
- Class I Design

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 Ambient Temperature	See derating curve	All	-20		+85	^{0}C
Operating Case Temperature		All			+85	^{0}C
Storage Temperature		All	-40		+100	^{0}C
Input/Output Isolation Voltage	1 minute	All	4242			Vdc

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
Input Current	100% Load, Vin=100Vac	All			1.5	A
Leakage Current	Vin=264Vac	All			3.5	mA
Inrush Current	Vin=240Vac, cold start at 25℃.	All			100	A

OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Set Point	Vin=Nominal Vin, Io=Io.max, Tc=25℃.	CBM100S120	11.88	12	12.12	Vdc
		CBM100S240	23.76	24	24.24	
		CBM100S280	27.72	28	28.28	
		CBM100S360	35.64	36	36.36	
		CBM100S480	47.52	48	48.48	
Operating Output Current Range		CBM100S120			8.4	A
		CBM100S240			4.2	
		CBM100S280			3.6	
		CBM100S360			2.8	
		CBM100S480			2.1	
Holdup Time	Vin=115Vac	All		12		ms
Output Voltage Regulation						
Load Regulation	20% to 60% & 60% to 100% rated load	All			±1.0	%
Line Regulation	Vin=high line to low line	All			±0.5	%
Over current Protection		All	130	160	200	%
Over Voltage Protection		CBM100S120		15		Vdc
		CBM100S240		30		
		CBM100S280		35		
		CBM100S360		45		
		CBM100S480		60		
Output Ripple and Noise	1. Add a 0.1uF ceramic capacitor and a 10uF aluminum electrolytic capacitor to output. 2. The bandwidth of oscilloscope is 20MHz 3. Ambient temperature=25℃	CBM100S120			120	mVp-p
		CBM100S240			240	
		CBM100S280			280	
		CBM100S360			360	
		CBM100S480			480	

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 rated. load	CBM100S120 CBM100S240 CBM100S280 CBM100S360 CBM100S480			8570 4220 3600 2860 2100	uF

EFFICIENCY

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Efficiency	1. Output is Rated Load 2.Ambient temperature=25℃ 3. Input voltage is 230Vac	CBM100S120 CBM100S240 CBM100S280 CBM100S360 CBM100S480		90 91 91 91 90.5		%

ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input to Output	1 minute	All			4242	Vdc
Input to Earth(Ground)	1 minute	All			2121	Vdc
Output to Earth(Ground)	1 minute	All			500	Vdc
Isolation Resistance		All	100			MΩ

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency		All		130		KHz

GENERAL SPECIFICATIONS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
MTBF	Vin = 115Vac, Io = 100%, Ta=25℃ per MIL-HDBK-217F	All	100			K Hours
Weight		Alll		236		g
Humidity	93% RH max. Non Condensing					
Safety	UL60950-1, EN60950-1, IEC60950-1					
EMC Emission (EMI)	EN55032 Class B, FCC CFR47 Part 15, EN61000-3-2, 3					
Conducted disturbance、Radiated disturbance	EN55032, FCC CFR47 Part 15					Class B
Harmonic current emissions	EN61000-3-2：2014					Class A
Voltage Fluctuation & Flicker	EN61000-3-3：2013					Criteria A
EMC Immunity (EMS)	IEC61000-4-2, 3, 4, 5, 6, 8, 11					
Electrostatic discharge (ESD)	EN61000-4-2 Contact ±4KV Perf., Air ±8KV Perf.					Criteria A
RF field strength (RS)	EN61000-4-3：2010					Criteria A
Electrical Fast Transient (EFT)	EN61000-4-4：2012, ±1KV Perf.					Criteria A
Surge	EN61000-4-5：2014, L-PE/ N-PE：± 2kV, L-N：± 1kV Perf.					Criteria A
RF Conducted Disturbance (CS)	EN61000-4-6：2013					Criteria A
Power frequency magnetic field	EN61000-4-8：2009					Criteria A
Voltage Dips	EN61000-4-11：2004					Criteria A
Voltage Interruptions	EN61000-4-11：2004					Criteria B

5. Main Features and Functions

5.1 Operating Temperature Range

The highly efficient design of Cincon's CBM100S series power modules has resulted in their ability to operate within ambient temperature environments from -20°C to 85°C. The derating curve was drawn from the CBM100S power module.

5.2 Output Protection

- ***Over Current Protection (OCP)***

CBM100S Series provide fully continuous short-circuit protection. The unit will auto recover until the short circuit is removed. To provide a protection in a fault condition, the unit is equipped with internal OCP. The unit will operate normally until the fault condition is removed. The power module will go to hiccup mode if output current reaches the condition of OCP, 130% to 200% rated current

- ***Over Voltage Protection***

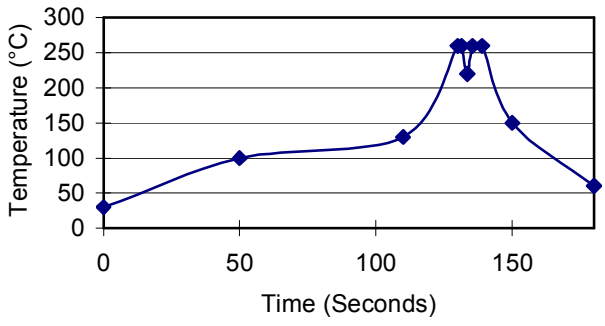
All different voltage models have a fully continuous over voltage protection. The power module will supply OVP, and the maximum voltage of OVP is 120% to 150% rated voltage. In the event of happen the OVP, the converter will shut down, and then It must recycle AC input to restart the converter.

6. Applications

6.1 Recommended Layout PCB Footprint and Soldering Information

The system designer or end user must ensure that metal and other components in the vicinity of the converter meet the spacing requirements for which the system is approved. Low resistance and inductance PCB layout traces are the norm and should be used where possible. Due consideration must also be given to proper low impedance tracks between power module, input and output grounds. The recommended soldering profile and PCB layout are shown below.

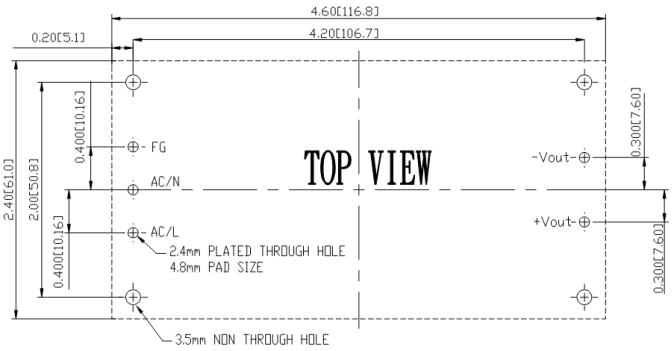
Lead Free Wave Soldering Profile



Note：

1. Soldering Materials: Sn/Cu/Ni
2. Ramp up Rate During Preheat: 1.4 ℃/Sec (From 50℃ to 100℃)
3. Soaking Temperature: 0.5 ℃/Sec (From 100℃ to 130℃), 60±20 Seconds
4. Peak Temperature:260℃, above 250℃ 3~6 Seconds
5. Ramp up Rate During Cooling: -10.0℃/Sec (From 260℃ to 150℃)

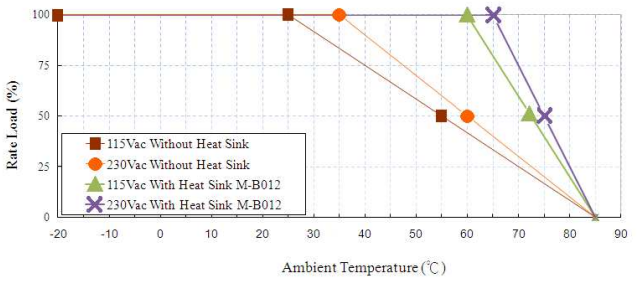
Recommended PCB Pad layout：

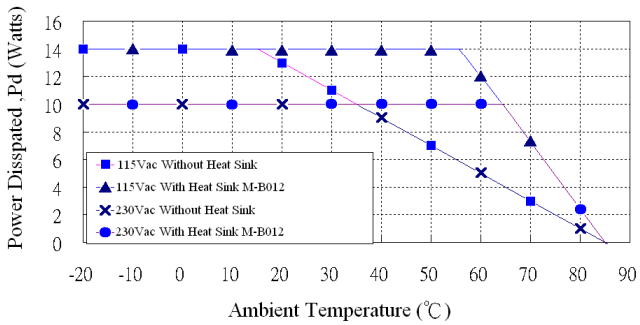


6.2 CBM100S Series Derating Curve

The operating ambient temperature range of CBM100S series is -20°C to +85°C. When operating the CBM100S series, proper derating is needed. The maximum case temperature under any operating condition should not exceed 85°C

The following chart is the derating curve of CBM100S series





Example :

What is the maximum ambient temperature of CBM100S120 operating at Vin=115Vac and 50% rated load with heat sink M-B012?

	Typical Thermal Resistance (Rca)
Heat Sink M-B012 Natural Convection 20ft./min.(0.1m/s)	2.07℃/W
No Heat Sink Natural Convection 20ft./min.(0.1m/s)	5.0℃/W

Solution:

Given:

Heat Sink M-B012 Thermal Resistance 2.07^{0}C/W

Vin=115Vac, Vo=12Vdc

When Io=4.2A, Efficiency=88.6%

Determine Power Dissipation (Pd):

Pd=Pi-Po=Po(1-η)/η

=12×4.2×(1-0.886)/0886=6.4Watts

Determine maximum ambient temperature:

Given: Pd=6.4W

Then check above Power derating curve

The maximum ambient temperature is about Ta=71℃

Verify:

Maximum temperature rise △T = Pd × Rca=6.4×2.07=13.248℃

Maximum ambient temperature Ta=Tc-△T=85-13.248=71.752℃

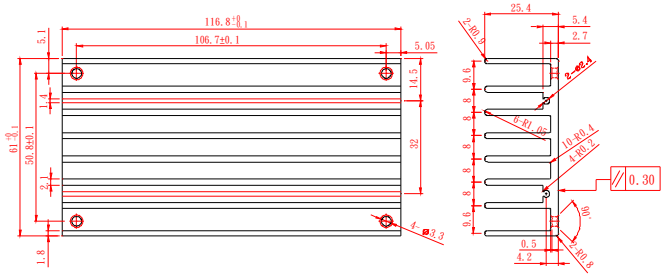
Where:

The Rca is thermal resistance from case to ambience

The Ta is ambient temperature and the Tc is case temperature

6.3 Full-Brick Heat Sink

Longitudinal Fins



Heat Sink: 116.8*61*25.4mm (M-B012-00A, G6620090204)
Thermal pad: SR60*115.8*0.23 (G6135013070)
Screw SMP+SW M3*8L (G75A1300322)
Rca: 2.07°C/W (typ.), at natural convection

6.4 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 CBM100S 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:

$$\eta = \frac{Vo \times Io}{Pin} \times 100\%$$

Where:

Vo is output voltage,

Io is output current,

Pin is input power

The value of load regulation is defined as:

$$Load_{reg.} = \frac{V_{Full-Load} - V_{60\%Full-Load}}{V_{60\%Full-Load}} \times 100\%$$

$$Load_{reg.} = \frac{V_{60\%Full-Load} - V_{20\%Full-Load}}{V_{20\%Full-Load}} \times 100\%$$

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

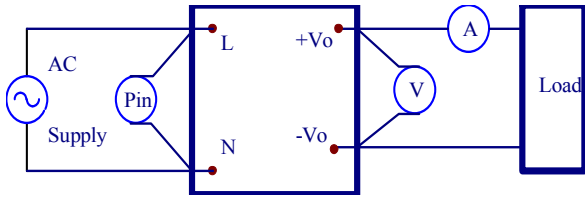


Figure 1. CBM100S Series Test Setup

6.5 Output Ripple and Noise Measurement

The test which set-up for noise and ripple measurement is shown in Figure 2.

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

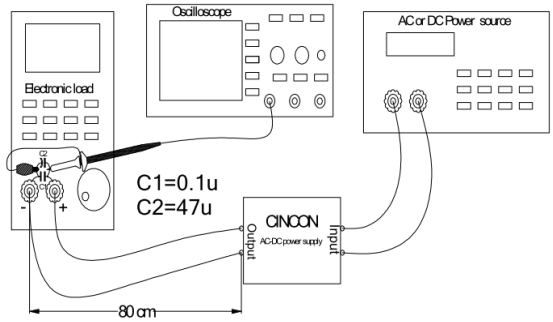
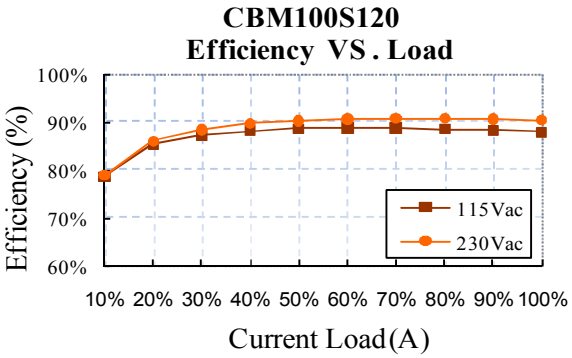
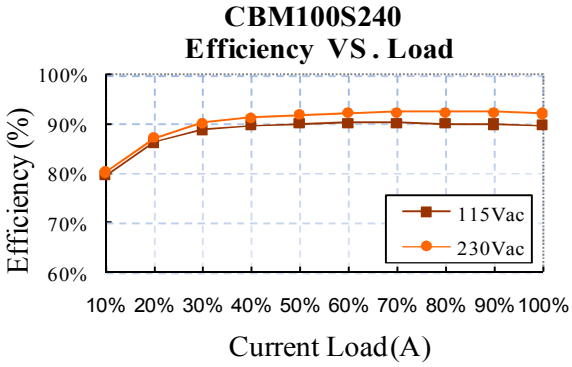
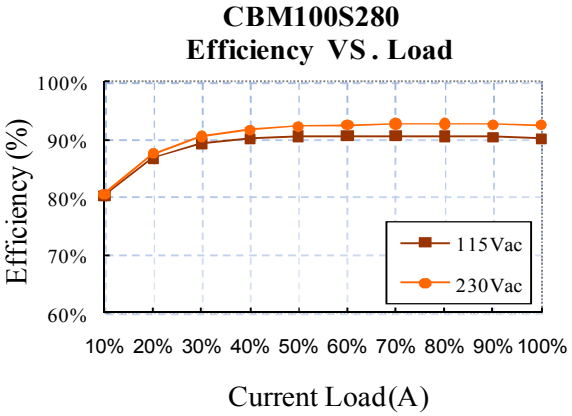


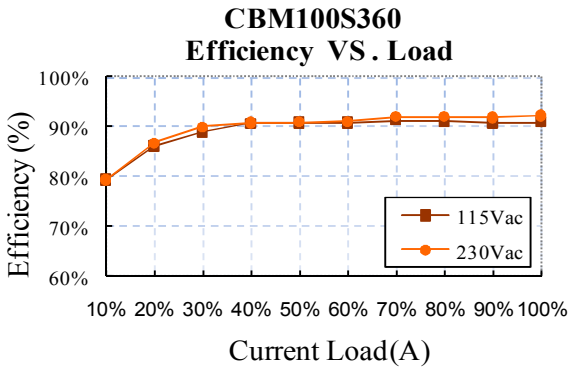
Figure 2. Output Voltage Ripple and Noise Measurement

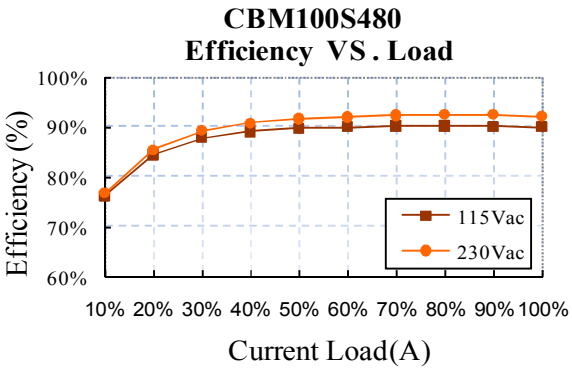
6.6 Efficiency VS. Load











7. EMC & Safety

■ Emission and Immunity

EN55032 Class B/EN55024, FCC CFR47 Part 15, EN61000-3-2, 3, IEC61000-4-2, 3, 4, 5, 6, 8, 11, EN61000-6-3

■ Safety

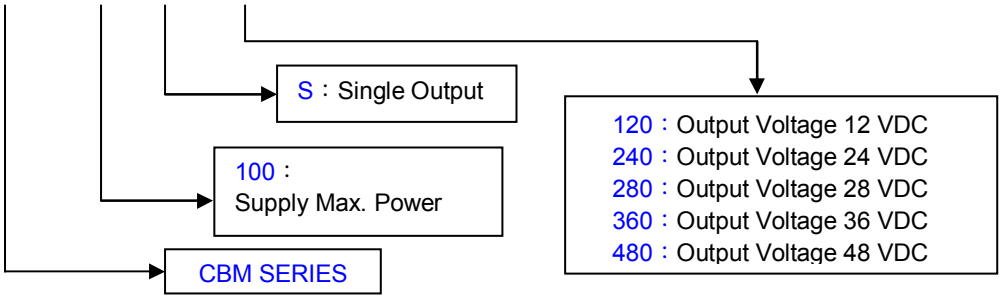
EN 60950-1:2006+A11+A1+A12+A2:2013

IEC 60950-1:2005+A1:2009

UL60950-1, 2nd Edition, 2011-12-19

8. Part Number

CBM XX S XXX



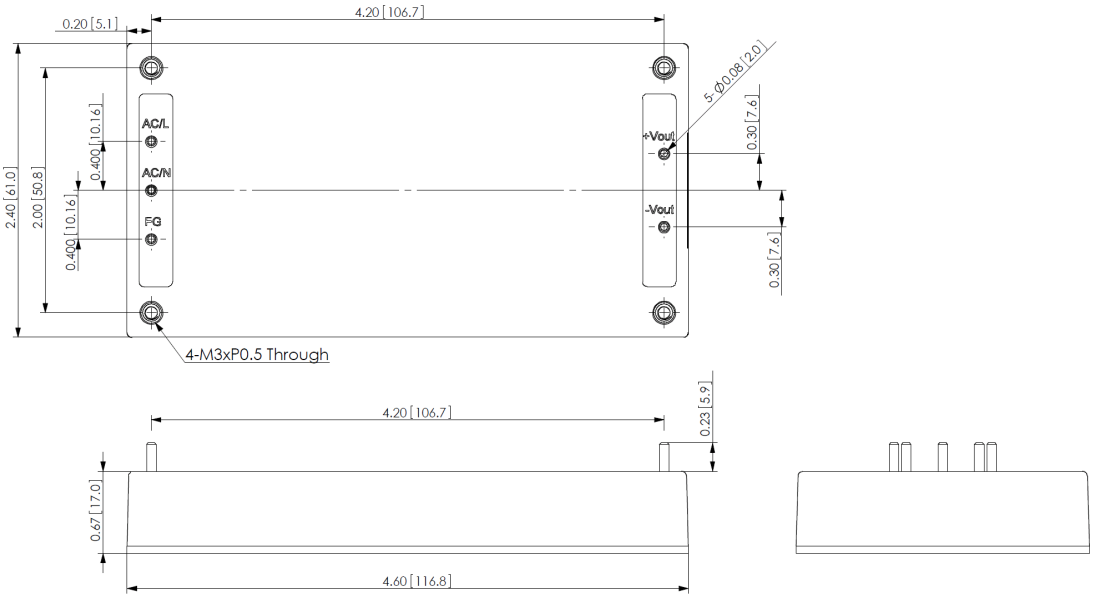
9. CBM100S Series Mechanical Outline Diagrams

9.1. Mechanical Outline Diagrams

All Dimensions In Inches[mm]

Tolerance: Inches:x.xx = ± 0.02 , x.xxx=± 0.010

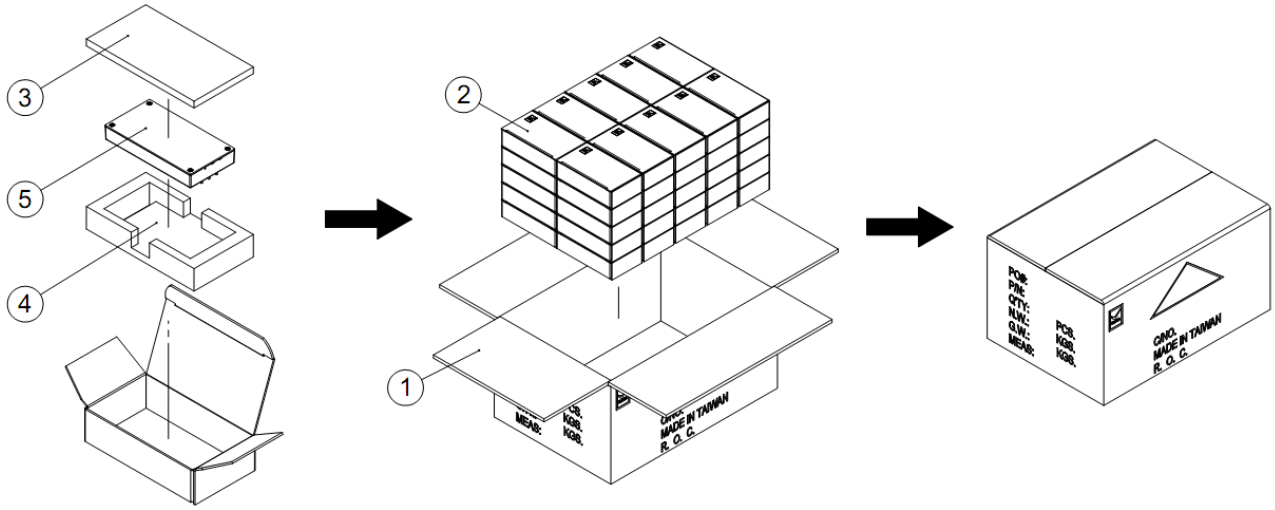
Millimeters:x.x = ± 0.5, x.xx±0.25



<Note> The baseplate connects with FG pin inside.

9.2. Packing Information

The packing information for CBM100S SERIES is showing as follows:



ITEM	PART NO.	NAME	OUTSIDE DIM(mm)	PCS
1	G64112340	No. 67 Cardboard Box	454.5*318.2*230.3mm	1
2	G64205237	Kraft Paper Box	15x8.5x4cm	50
3	G64301061	Anti-static Foam	147*81*8mm	50
4	G64301118	Anti-static Foam	147*81*26.6mm	50
5	G98~	CBM100S Product	116.8*61*17mm	50

Each Box Packaging 50 PCS Products
Gross weight Ref. 14.8 Kg
Net weight Ref. 11.8 Kg

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