

Features

- Universal Input Range 90~264V_{ac}
- High Efficiency up to 94.5%
- Class I
- No Load Input Power Consumption<0.5W
- Peak Power Operation up to 120Watt for 5s
- Approval IEC/EN/UL 62368-1
- Approval EN 55032 and CISPR/FCC Class B
- Operating Altitude 5000m
- Continuous Short Circuit Protection
- Over Voltage Protection
- Over Temperature Protection
- Low Inrush Current < 8.5A
- 17mm Ultra Low Profile Package
- Full Load without Heat Sink
- No Fan Required
- Built-in EMI Filters Bulk Capacitor and Output Capacitors
- Wide Operating Temperature Range



MODEL NUMBER	OUTPUT VOLTAGE	OUTPUT CURRENT	RIPPLE & NOISE NOTE1	VOLTAGE ACCURACY NOTE2	LINE REGULATION NOTE3	LOAD REGULATION NOTE4	%EFF. (Typ.) NOTE5
CBM101S120	12 V	8.4 A	120 mV	±1%	±0.5%	±0.5%	93.5%
CBM101S240	24 V	4.2 A	150 mV	±1%	±0.5%	±0.5%	94.5%
CBM101S280	28 V	3.6 A	240 mV	±1%	±0.5%	±0.5%	94.5%
CBM101S360	36 V	2.8 A	280 mV	±1%	±0.5%	±0.5%	94.5%
CBM101S480	48 V	2.1 A	300 mV	±1%	±0.5%	±0.5%	94.5%

Note:

1. Add a 0.1uF ceramic capacitor and a 10uF E.L. capacitor to output for ripple & noise measuring @20MHz BW.
2. Voltage accuracy is set at full load.
3. Line regulation is measured from 100Vac to 240Vac with full load.
4. Load regulation is measured from 10% to 100% full load.
5. Typical efficiency at 230 VAC and full load at 25°C.
6. Power Dissipation (Pd): $P_d = P_i - P_o = P_o(1-\eta)/\eta$.

PART NUMBER

Series	Number of Outputs	Nominal Output Voltage
CBM101	O	XXX
CBM101	S : Single	120 : 12VDC 240 : 24VDC 280 : 28VDC 360 : 36VDC 480 : 48VDC

Part Number Example:

CBM101S120: Brick Power, 100W, Single 12Vdc Output

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.	Typ.	Max.	Units
Input Voltage	Safety approvals only to the AC input	All	90		264	V _{ac}
			120		370	V _{dc}
Operating Temperature	See Derating Curve	All	-40		85	°C
Operating Case Temperature	At the center of base plate (T _c = Case temperature)	All	-40		90	°C
Storage Temperature		All	-40		100	°C
Input/Output Isolation Voltage	1 minute	All			4000	V _{ac}
Operating Altitude		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	47		63	Hz
Maximum Input Current	100% Load, V _{in} =100V _{ac}	All			1.5	A
Inrush Current	V _{in} =240V _{ac} , Cold start at 25°C	All		8.5		A
Leakage Current (Earth)		All			250	uA
Leakage Current (Touch)		All			100	uA
Under Voltage Protection		All	55	65	75	V _{ac}
Power Factor	230V _{ac} /50Hz at full load	All	0.91			

OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Output Voltage Set Point	V _{in} =90V _{ac} ~264V _{ac} , full load Ambient temperature=25°C	CBM101S120	11.88	12	12.12	V _{dc}
		CBM101S240	23.76	24	24.24	
		CBM101S280	27.72	28	28.28	
		CBM101S360	35.64	36	36.36	
		CBM101S480	47.52	48	48.48	
Operating Output Current Range	V _{in} =90V _{ac} ~264V _{ac} , See Derating Curve	CBM101S120			8.4	A
		CBM101S240			4.2	
		CBM101S280			3.6	
		CBM101S360			2.8	
		CBM101S480			2.1	
Holdup Time	V _{in} =115V _{ac} at 25°C, full load	CBM101S120	30	40		ms
		CBM101S240	30	40		
		CBM101S280	20	30		
		CBM101S360	30	40		
		CBM101S480	30	40		
Startup Delay Time	V _{in} =90V _{ac} ~264V _{ac}	All		1		S
Temperature Coefficient	T _c =-40°C to 50°C	All			±0.02	%/°C
Load Regulation	10% Load to full load	All			±0.5	%
Line Regulation	V _{in} =High line to low line	All			±0.5	%
Over Voltage Protection	Latch off (AC recycle to restart)	CBM101S120			16	V _{dc}
		CBM101S240			35	
		CBM101S280			35	
		CBM101S360			50	
		CBM101S480			63	

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Over Current Protection	Hiccup mode, auto recovery	All	120	135	150	%
Short Circuit Protection	Auto recovery	All				
Peak Power	1. Vin=115Vac and 230Vac 2. Ambient temperature=25°C 3. Peak power should be less than 5seconds, with a maximum 10% duty cycle, peak power function by 120% load 5S and 75% load 45S	All		120		%
Over Temperature Protection	Auto recovery	All				
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	CBM101S120 CBM101S240 CBM101S280 CBM101S360 CBM101S480			120 150 240 280 300	mV
Load Capacitance	1. Input voltage is 115Vac and 230Vac 2. Output is full load 3. Ambient Temperature=25°C	CBM101S120 CBM101S240 CBM101S280 CBM101S360 CBM101S480			8400 4200 3600 2800 2100	uF

EFFICIENCY

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Efficiency	1. Input Voltage is 230Vac 2. Output is full load 3. Ambient Temperature=25°C	CBM101S120 CBM101S240 CBM101S280 CBM101S360 CBM101S480		93.5 94.5 94.5 94.5 94.5		%

ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Input to Output	1 Minute (without dielectric breakdown)	All			4000	V _{ac}
Input to Earth (Ground)	1 Minute (without dielectric breakdown)	All			1800	V _{ac}
Output to Earth (Ground)	1 Minute (without dielectric breakdown)	All			1800	V _{ac}
Isolation Resistance	Input to output	All	100			MΩ

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Switching Frequency	Output is full load	All		110		kHz

GENERAL SPECIFICATIONS

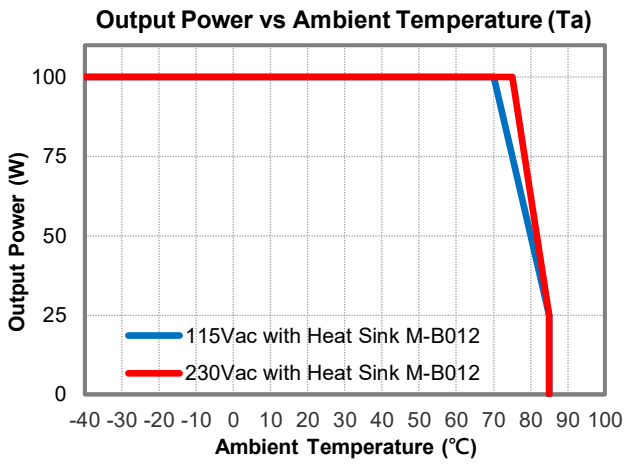
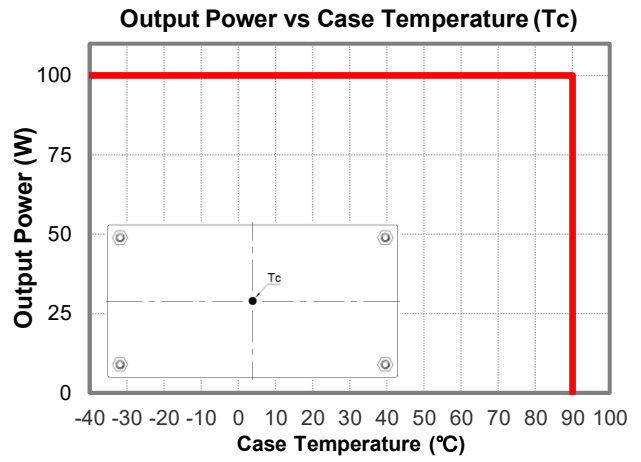
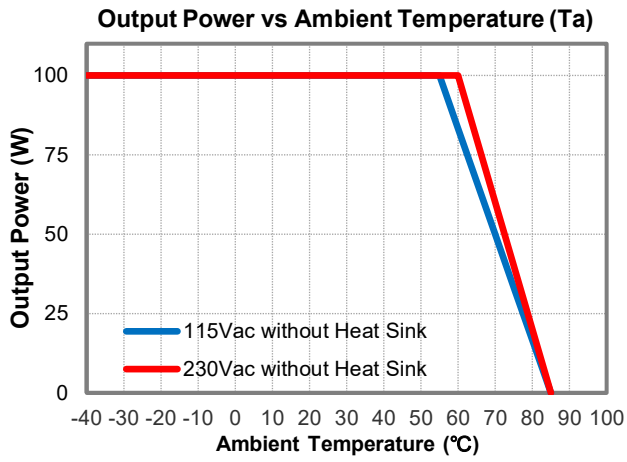
PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
MTBF	I _o =100%; T _a =25°C per MIL-HDBK-217F I _o =100%, T _a =25°C, Telcordia SR332	All		600 2000		k hours
Life Time	Without heat sink@75% load, T _a =50°C	All		85		k hours
Humidity	Non-condensing	All			93	% RH
Shock	Meets MIL-STD-810F Table 516.5, Table 516.5-I 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), total 3 hrs.	All		4		g
Weight		All		240		grams
Dimensions		All	4.60x2.40x0.67 Inches (116.8x61.0x17.0 mm)			

GENERAL SPECIFICATIONS

Safety	Class I, IEC/EN/UL 62368-1	Ed. 3.0
EMC Emission	EN 55032: 2015+A11: 2020, EN 61000-6-3 2007+A1: 2011+AC: 2012, Class B EN 61000-6-4:2019, 47 CFR FCC Part 15 Subpart B, EN 61204-3:2018, EN 61000-3-2: 2019, EN 61000-3-3: 2013+A1: 2019	Class B
Conducted Disturbance	EN 55032: 2015+A11: 2020, EN 61000-6-3 2007+A1: 2011+AC: 2012, Class B EN 61000-6-4:2019, 47 CFR FCC Part 15 Subpart B, EN 61204-3:2018	Class B
Radiated Disturbance	EN 55032: 2015+A11: 2020, EN 61000-6-3 2007+A1: 2011+AC: 2012, Class B EN 61000-6-4:2019, 47 CFR FCC Part 15 Subpart B, EN 61204-3:2018	Class B
Harmonic Current Emissions	EN 61000-3-2:2019	Class A
Voltage Fluctuations & Flicker	EN 61000-3-3:2013+A1:2019	Criterion A
EMC Immunity	EN 55035: 2017+A11: 2020, EN 61204-3: 2018, EN 61000-6-1: 2019, EN 61000-6-2: 2019 EN 61000-6-4-2, 3, 4, 5, 6, 8, 11	
Electrostatic Discharge (ESD)	IEC 61000-4-2:2008, Air Discharge: $\pm 8\text{kV}$, Contact Discharge: $\pm 4\text{kV}$	Criterion A
Radio-Frequency, Continuous Radiated Disturbance	IEC 61000-4-3:2020	Criterion A
Electrical Fast Transient (EFT)	IEC 61000-4-4:2012, $\pm 1\text{kV}$, $\pm 2\text{kV}$	Criterion A
Surge	IEC 61000-4-5:2014+A1:2017, L-N: $\pm 0.5\text{kV}$, $\pm 1\text{kV}$, L-E(ground): $\pm 0.5\text{kV}$, $\pm 1\text{kV}$, $\pm 2\text{kV}$	Criterion A
Conducted Disturbances, Induced by RF Fields	IEC 61000-4-6:2013+COR1:2015	Criterion A
Power Frequency Magnetic Field	IEC 61000-4-8:2009	Criterion A
Voltage Dips	IEC 61000-4-11:2020, Dip: 30% Reduction, Dip >95% Reduction	Criterion A
Voltage Interruptions	IEC 61000-4-11:2020, >95% Reduction	Criterion B

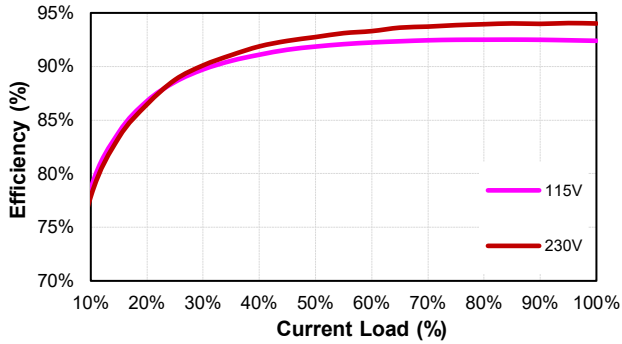
CHARACTERISTIC CURVE

Power Derating Curve

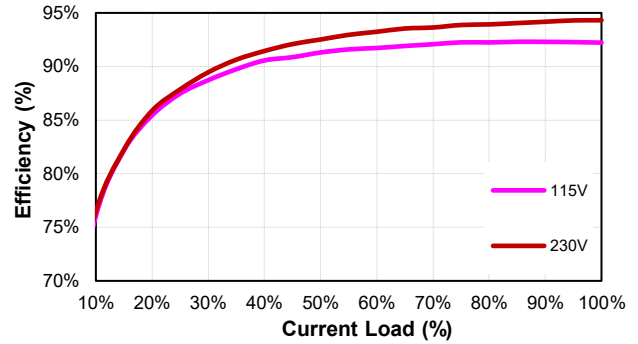


Performance Data

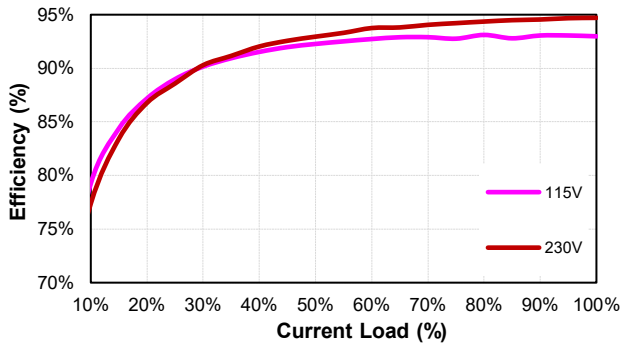
CBM101S120 (Eff Vs Io)



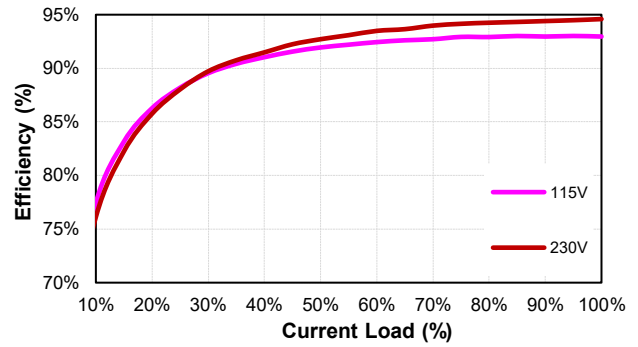
CBM101S240 (Eff Vs Io)



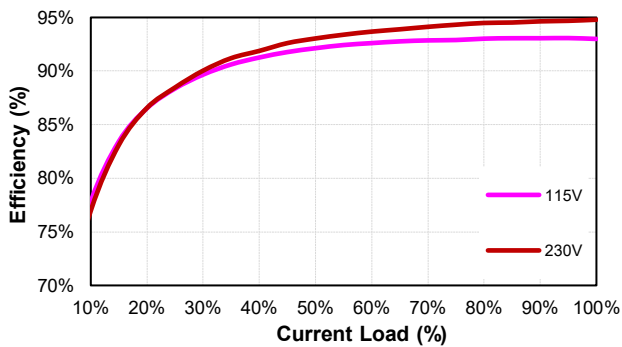
CBM101S280 (Eff Vs Io)



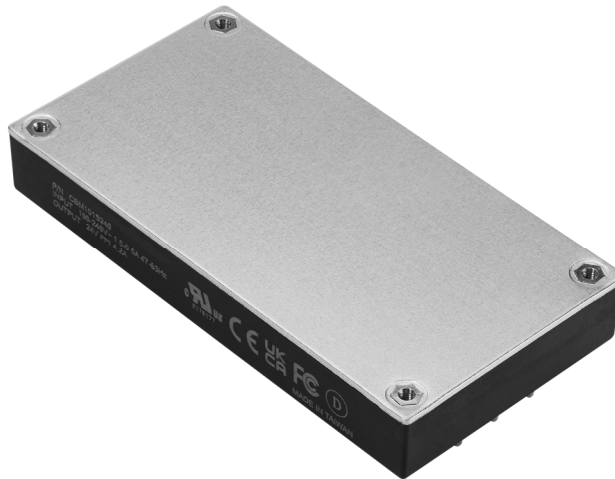
CBM101S360 (Eff Vs Io)



CBM101S480 (Eff Vs Io)



AC-DC Switching Brick Power Module
CBM101S Series
Application Note





CBM101S Series Application Note V12

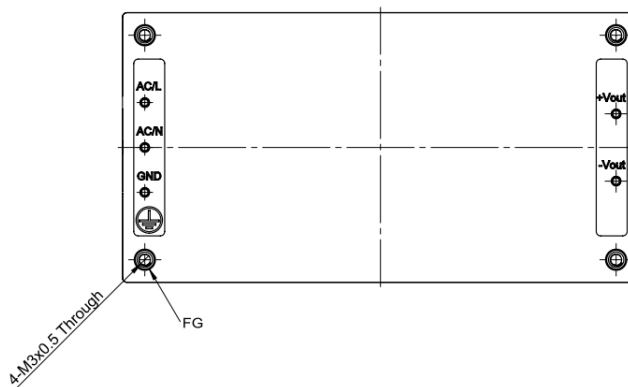
Contents

- 1. Introduction 3
- 2. Pin Function Description 3
- 3. Electrical Block Diagram 3
- 4. Test Set-Up..... 4
- 5. Installation Instruction 4
- 6. Features and Functions 4
 - 6.1 Over Current Protection..... 4
 - 6.2 Over Voltage Protection..... 4
 - 6.3 Over Temperature Protection..... 4
- 7. Input / Output Considerations 5
 - 7.1 Output Ripple and Noise Measurement 5
- 8. Thermal Design..... 6
 - 8.1 Operating Temperature Range 6
 - 8.2 Convection Requirements for Cooling..... 6
 - 8.3 Thermal Considerations..... 6
 - 8.4 Power Derating..... 6
 - 8.5 Full Brick Heat Sinks 8
- 9. Packing Information 9

1. Introduction

This application note describes the features and functions of the CBM101S series, switching AC-DC brick power module. The CBM101S does not require any extremal components to pass EMI class B. 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. Our world class automated manufacturing methods, together with an extensive testing and qualification program, ensure that the CBM101S series brick power module is extremely reliable.

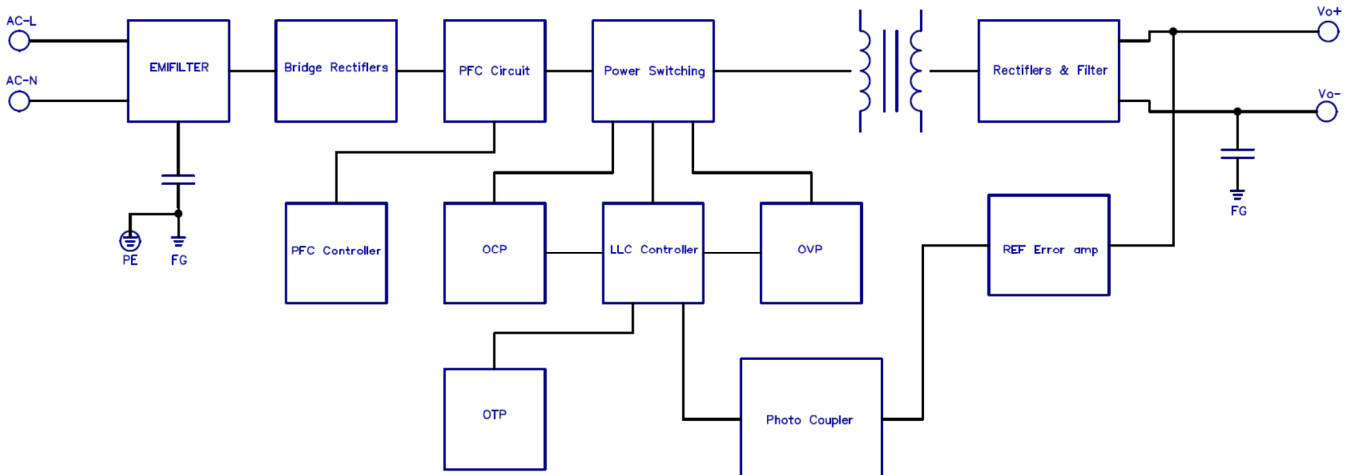
2. Pin Function Description



No	Label	Function	Description
1	AC/L	AC Line	Positive Supply Input
2	AC/N	AC Neutral	Negative Supply Input
3	GND	Mounting Insert	Mounting Insert (GND)
4	+Vout	+V Output	Positive Power Output
5	-Vout	-V Output	Negative Power Output

Note: Base plate can be connected to FG through M3 threaded mounting insert. Recommended torque 3Kgf-cm.

3. Electrical Block Diagram



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 CBM101S 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:

- Efficiency
- Load regulation and line regulation

The value of efficiency is defined as:

$$\eta = \frac{V_o \times I_o}{V_{in} \times I_{in}} \times 100\%$$

Where:

- V_o is output voltage,
- I_o is output current,
- V_{in} is input voltage,
- I_{in} is input current

The value of load regulation is defined as:

$$Load\ reg. = \frac{V_1 - V_2}{V_2} \times 100\%$$

Where:

- V_1 is the output voltage at full load
- V_2 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.

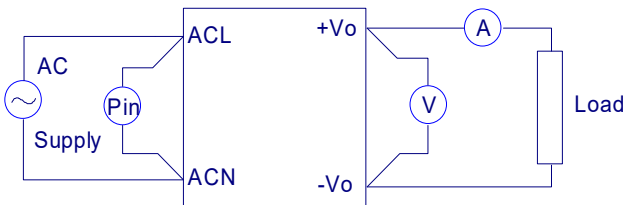
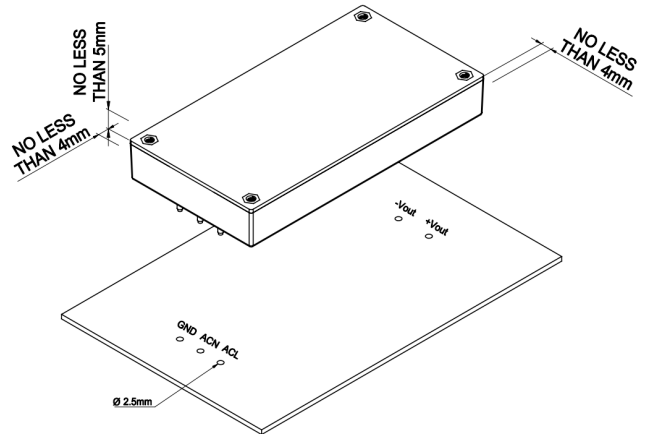


Figure 1. CBM101S Series Test Setup

5. Installation Instruction

The CBM101S mounting holes are 2.5mm. 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.



6. Features and Functions

6.1 Over Current Protection

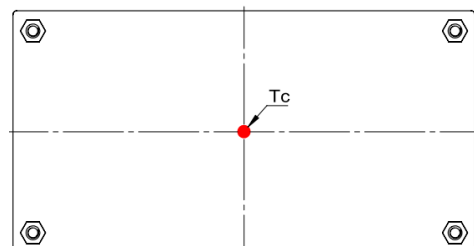
All models have internal over current and continuous short circuit protection. The unit operates normally once the fault condition is removed. At the point of current limit inception, the converter will go into hiccup mode protection.

6.2 Over Voltage Protection

All different voltage models have a fully continuous over voltage protection. The power module will supply OVP. In the event of happen the OVP, the converter will shut down, the converter will go into hiccup mode protection.

6.3 Over Temperature Protection

These modules have an over temperature protection circuit to safeguard against thermal damage. Shutdown occurs with the maximum case reference temperature is exceeded. The module will restart when the case temperature falls below over temperature recovery threshold. Please measure case temperature of the center part of aluminum base plate.



7. Input / Output Considerations

7.1 Output Ripple and Noise Measurement

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

Add a C2=0.1uF ceramic capacitor and a C1=10uF electrolytic capacitor to output at 20 MHz bandwidth.

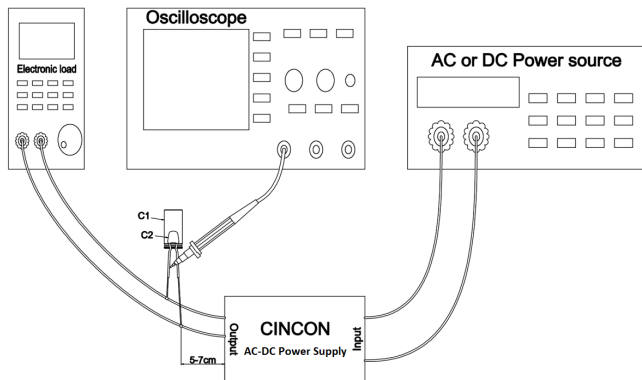


Figure 2. Output Voltage Ripple and Noise Measurement Set-Up

8. Thermal Design

8.1 Operating Temperature Range

The highly efficient design of the CBM101S series brick power modules has resulted in their ability to operate within ambient temperature environments from -40°C to +85°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)
- Forced air or natural convection
- Heat sink (optional)

8.2 Convection Requirements for Cooling

To predict the approximate cooling needed for the brick module, refer to the power derating curves in **section 8.4**. These derating curves are approximations of the ambient temperatures and airflows required to keep the power module temperature below its maximum rating. Once the module is assembled in the actual system, the module's temperature should be monitored to ensure it does not exceed 90°C (T_c) as measured at the center of the top of the case (thus verifying proper cooling).

8.3 Thermal Considerations

The power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. The example is presented in **section 8.4**. The power output of the module should not be allowed to exceed rated power (V_{o_set} x I_{o_max}).

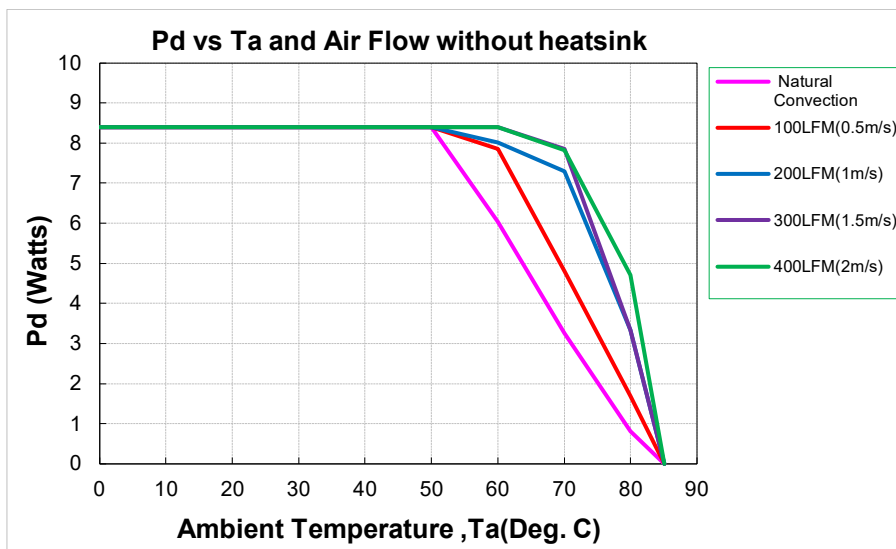
8.4 Power Derating

The operating case temperature range of CBM101S series is -40°C to +90°C (T_c). When operating the CBM101S series, proper derating or cooling is needed. (at 115V_{ac} & 230V_{ac})

The maximum case temperature under any operating condition should not exceed 90°C.

The following curve is the derating curve of CBM101S series without heatsink.

Note: Pd is calculated after 1 minute of burn-in



AIR FLOW RATE	TYPICAL R _{ca}
Natural Convection	4.81°C/W
100 ft./min. (0.5m/s)	3.85°C/W
200 ft./min. (1.0m/s)	2.75°C/W
300 ft./min. (1.5m/s)	2.43°C/W
400 ft./min. (2.0m/s)	2.05°C/W

Example without heatsink:

What is the minimum airflow necessary for a CBM101S120 operating at 230Vac, an output current of 8.4A, and a maximum ambient temperature of 50°C without heatsink?

Solution:

Given: $V_{in}=115V_{ac}$, $V_o=12V_{dc}$, $I_o=8.4A$

Determine Power dissipation (P_d): $P_d=P_i-P_o=P_o(1-\eta)/\eta$, $P_d=12V \times 8.4A \times (1-0.927)/0.927=7.94Watts$

Determine airflow: Given: $P_d=7.94W$ and $T_a=50^\circ C$

Verify:

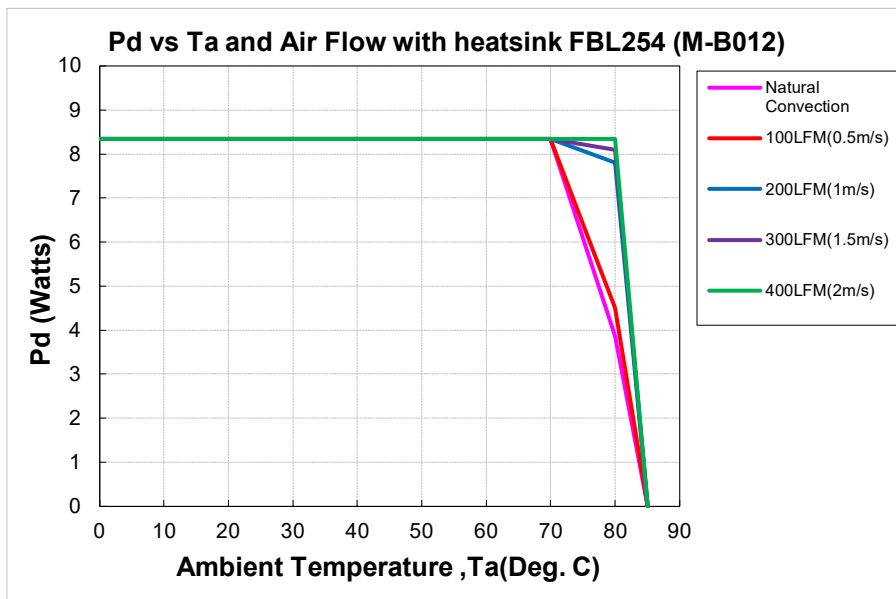
Maximum temperature rise is $\Delta T=P_d \times R_{ca}=7.94 \times 4.81=38.2^\circ C$

Maximum case temperature is $T_c=T_a+\Delta T=88.2^\circ C < 90^\circ C$

Where:

The R_{ca} is thermal resistance from case to ambient environment.

T_a is ambient temperature and T_c is case temperature.



AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection	2.48°C/W
100 ft./min. (0.5m/s)	2.14°C/W
200 ft./min. (1.0m/s)	1.4°C/W
300 ft./min. (1.5m/s)	1.1°C/W
400 ft./min. (2.0m/s)	0.95°C/W

Example with heatsink FBL254 (M-B012):

What is the minimum airflow necessary for a CBM101S120 operating at 230Vac, an output current of 8.4A, and a maximum ambient temperature of 70°C with heatsink FBL254 (M-B012).

Solution:

Given: $V_{in}=115V_{ac}$, $V_o=12V_{dc}$, $I_o=8.4A$

Determine Power dissipation (P_d): $P_d=P_i-P_o=P_o(1-\eta)/\eta$, $P_d=12V \times 8.4A \times (1-0.927)/0.927=7.94Watts$

Determine airflow: Given: $P_d=7.94W$ and $T_a=70^\circ C$

Check above Power de-rating curve: Minimum airflow= Natural Convection

Verify:

Maximum temperature rise is $\Delta T=P_d \times R_{ca}=7.94 \times 2.48=19.7^\circ C$

Maximum case temperature is $T_c=T_a+\Delta T=89.7^\circ C < 90^\circ C$

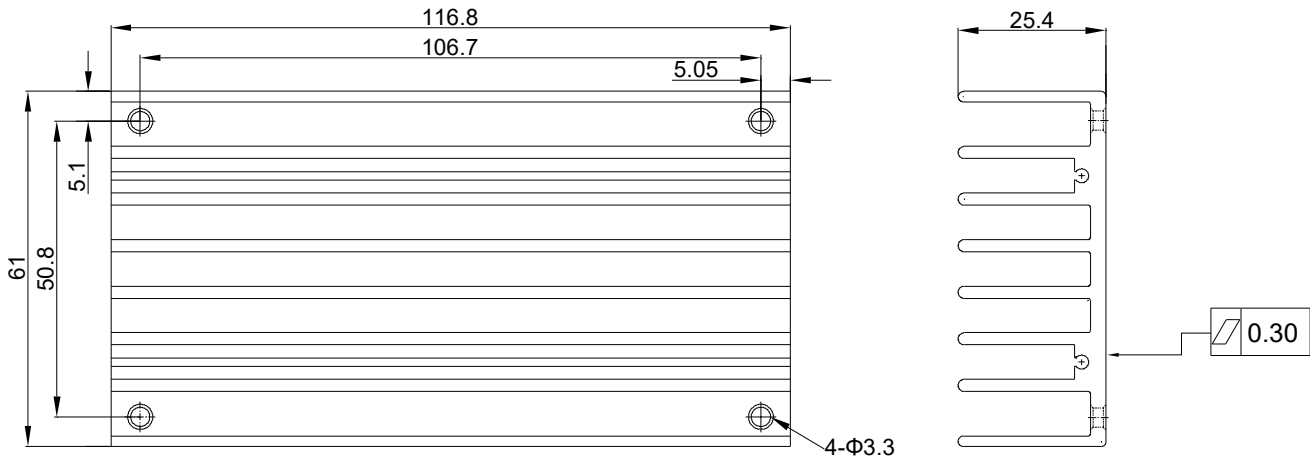
Where:

The R_{ca} is thermal resistance from case to ambient environment.

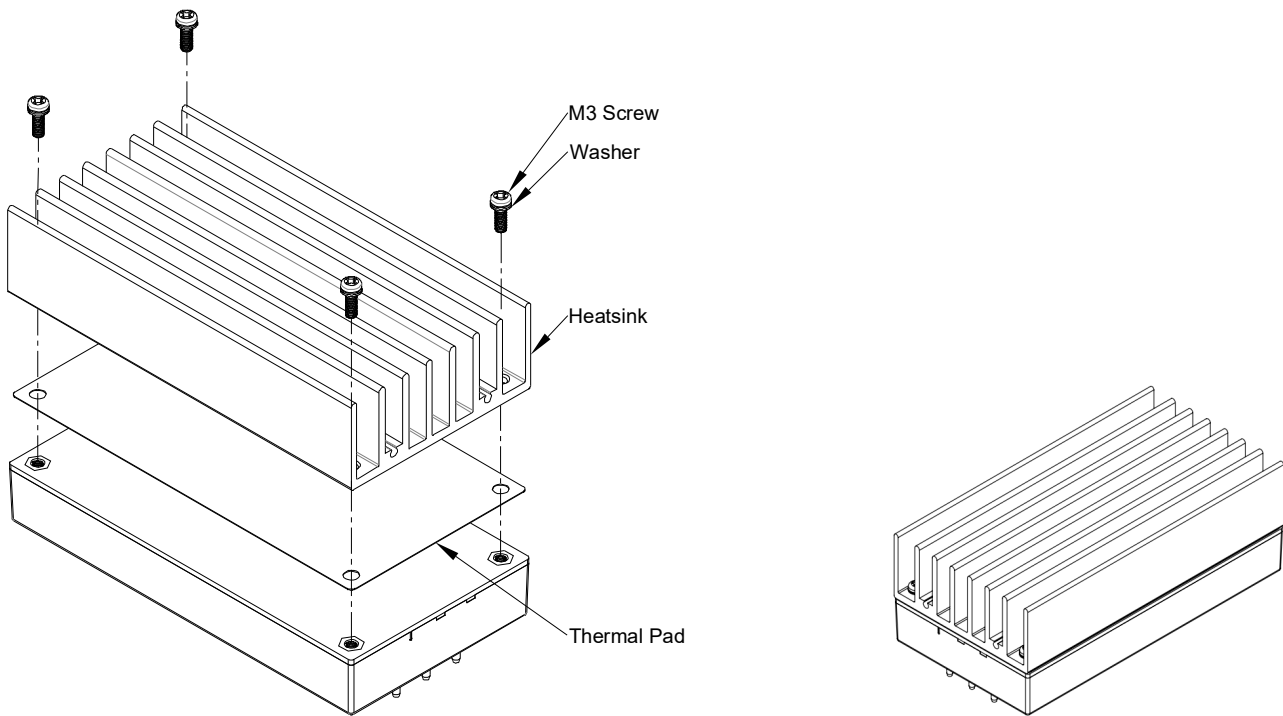
T_a is ambient temperature and T_c is case temperature.

8.5 Full Brick Heat Sinks

All Dimension In mm

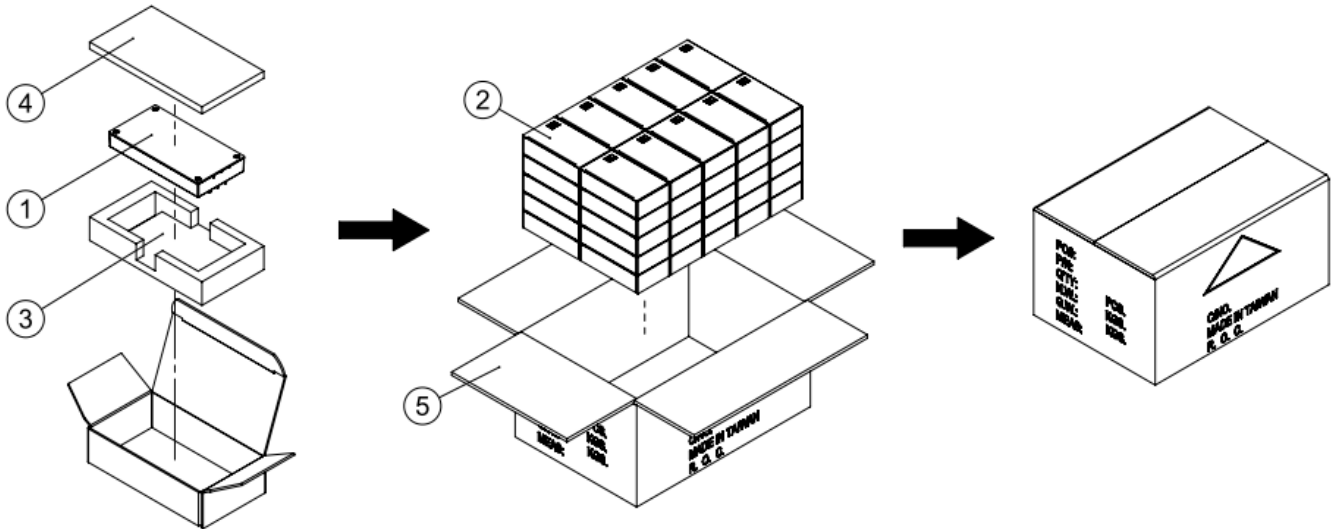


Heat Sink (Clear Mounting Inserts Φ3.3mm Through): 116.8*61*25.4 FBL254 (M-B012) G6620090204
 Thermal PAD PF01: 60*115.8*0.23 (G6135041073)
 Screw & Washer K308W: SMP+WS M3x8L (G75A1300322)



9. Packing Information

The packing information for CBM101S series is showing as follows:



ITEM	PART NO.	NAME	OUTSIDE DIM(mm)	PCS
1	-	CBM101SXXX Product	116.8x61x17	50
2	G64205237	Inner Box	150x85x40	50
3	G64301118	Antistatic Foam	147x81x26.6	50
4	G64301061	Antistatic Foam	147x81x8	50
5	G64112340	No. 67 Cardboard Box	454.5x318.2x230.3	1

Each Box Packaging 50PCS Products

Gross Weight Ref. 14.8Kg