

Features

- Universal Input Range 90~264Vac
- High Efficiency up to 94%
- Class I
- No Load Input Power Consumption<0.5W
- Peak Power Operation up to 360Watt 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
- 19.7mm Ultra Low-Profile Package
- Full Load with Baseplate Cooled and No Fan Required
- Build in EMI Filters Bulk Capacitor and Output Capacitors
- High Power Density 24.95W/Inches³
- Wide Operating Temperature Range



MODEL NUMBER	OUTPUT VOLTAGE	OUTPUT CURRENT	RIPPLE & NOISE NOTE1	VOLTAGE ACCURACY NOTE2	LINE REGULATION NOTE3	LOAD REGULATION NOTE4	TRIM	%EFF. (Typ.) NOTE5
CBM300S120	12 V	25.0 A	1%	±1%	±0.5%	±1%	±5%	92%
CBM300S150	15 V	20.0 A	1%	±1%	±0.5%	±1%	±5%	92%
CBM300S240	24 V	12.5 A	1%	±1%	±0.5%	±1%	±5%	93%
CBM300S280	28 V	10.71 A	1%	±1%	±0.5%	±1%	±5%	93%
CBM300S360	36 V	8.33 A	1%	±1%	±0.5%	±1%	±5%	94%
CBM300S480	48 V	6.25 A	1%	±1%	±0.5%	±1%	±5%	94%
CBM300S540	54 V	5.55 A	1%	±1%	±0.5%	±1%	±5%	94%

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): $Pd = Pi - Po = Po(1-\eta)/\eta$.

PART NUMBER

Series	Number of Outputs	Nominal Output Voltage
CBM300	O	XXX
CBM300	S: Single	120: 12VDC 150: 15VDC 240: 24VDC 280: 28VDC 360: 36VDC 480: 48VDC 540: 54VDC

Part Number Example:

CBM300S120: Brick Power, 300W, 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}
					370	V_{dc}
Operating Temperature	At the center of base plate (T_c = Case temperature)	All	-40		90	°C
Storage Temperature		All	-40		100	°C
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			4	A
Inrush Current	$V_{in}=240V_{ac}$, Cold start @25°C	All			40	A
Leakage Current (Earth)		All			0.75	mA
Power Factor	230 V_{ac} /50Hz @ Full Load	All	0.95	0.98		

OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Output Voltage Set Point	$V_{in}=90V_{ac}\sim 264V_{ac}$, I_o =Full load Ambient temperature=25°C	CBM300S120	11.88	12	12.12	V_{dc}
		CBM300S150	14.85	15	15.15	
		CBM300S240	23.76	24	24.24	
		CBM300S280	27.72	28	28.28	
		CBM300S360	35.64	36	36.36	
		CBM300S480	47.52	48	48.48	
		CBM300S540	53.46	54	54.54	
Output Voltage Trim Range	$P_o \leq$ max. rated power, $I_o \leq I_{o_max}$.	All		±5		%
Operating Output Current Range	$V_{in}=90V_{ac}\sim 264V_{ac}$, see derating curve	CBM300S120			25	A
		CBM300S150			20	
		CBM300S240			12.5	
		CBM300S280			10.71	
		CBM300S360			8.33	
		CBM300S480			6.25	
		CBM300S540			5.55	
Holdup Time	$V_{in}=115V_{ac}$ (Full load)	All	20	25		ms
Load Regulation	10% Load to Full Load	All			±1.0	%
Line Regulation	V_{in} =High line to low line	All			±0.5	%
Over Voltage Protection	Latch off (AC recycle to reset)	CBM300S120			15	V_{dc}
		CBM300S150			20	
		CBM300S240			32	
		CBM300S280			35	
		CBM300S360			43	
		CBM300S480			56	
		CBM300S540			60	
Over Current Protection	Auto recovery	All	125		175	%
Short Circuit Protection	Auto recovery	All				
Over Temperature Protection	Auto recovery	All				

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
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	CBM300S120			120	mV
		CBM300S150			150	
		CBM300S240			240	
		CBM300S280			280	
		CBM300S360			360	
		CBM300S480			480	
		CBM300S540			540	
Load Capacitance	1. Input Voltage is 115V _{ac} and 230V _{ac} 2. Output is max. Full Load 3. Ambient Temperature=25°C	CBM300S120			25000	uF
		CBM300S150			20000	
		CBM300S240			12500	
		CBM300S280			10700	
		CBM300S360			8300	
		CBM300S480			6250	
		CBM300S540			5550	

EFFICIENCY

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Efficiency	1. Input Voltage is 230V _{ac} 2. Output is 75% Full Load 3. Ambient Temperature=25°C	CBM300S120		92		%
		CBM300S150		92		
		CBM300S240		93		
		CBM300S280		93		
		CBM300S360		94		
		CBM300S480		94		
		CBM300S540		94		

ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typ.	Max.	Units
Input to Output	1 Minute (without dielectric breakdown)	All			3000	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		All		75		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 per Telcordia SR332	All	240			k hours
Life Time	@75% Load, 40°C	All	44			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		423		grams
Dimensions		All	4.60x3.35x0.78 Inches (116.8x85.0x19.7 mm)			

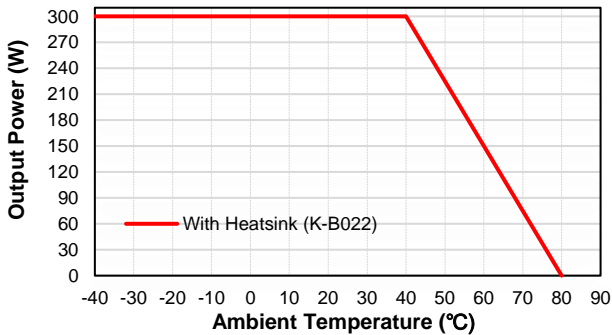
GENERAL SPECIFICATIONS

Safety	Class I, IEC/EN/UL 62368-1	Ed. 3.0
EMC Emission	EN 55032, IEC/EN 61000-6-4, EN 61204-3, IEC/EN 61000-3-2, EN 61000-3-3, 47 CFR FCC Part 15	
Conducted Disturbance	EN 55032, 47 CFR FCC Part 15 Subpart B	Class B
Radiated Disturbance	EN 55032, 47 CFR FCC Part 15 Subpart B	Class B
Harmonic Current Emissions	EN 61000-3-2	Class A, C, D
Voltage Fluctuations & Flicker	EN 61000-3-3	Criterion A
EMC Immunity	EN 55035, IEC/EN 61000-6-2, EN 61204-3, IEC/EN 61000-4-2, 3, 4, 5, 6, 8, 11	
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 3: Air Discharge: $\pm 8\text{kV}$, Level 2: Contact Discharge: $\pm 4\text{kV}$	Criterion A
Radio-Frequency, Continuous Radiated Disturbance	IEC 61000-4-3, Level 3: 80~1000MHz, 10V/m	Criterion A
Electrical Fast Transient (EFT)	IEC 61000-4-4, Level 3: $\pm 2\text{kV}$	Criterion A
Surge	IEC 61000-4-5, Level 3: L-N: $\pm 1\text{kV}$, L-E(Ground): $\pm 2\text{kV}$	Criterion A
Conducted Disturbances, Induced by RF Fields	IEC 61000-4-6, Level 3: 0.15~80MHz, 10V	Criterion A
Power Frequency Magnetic Field	IEC 61000-4-8, Level 4: 30A/m	Criterion A
Voltage Dips	IEC/EN 61000-4-11, Dip: 30% Reduction IEC/EN 61000-4-11, Dip >95% Reduction	Criterion A
Voltage Interruptions	IEC 61000-4-11, >95% Reduction	Criterion B

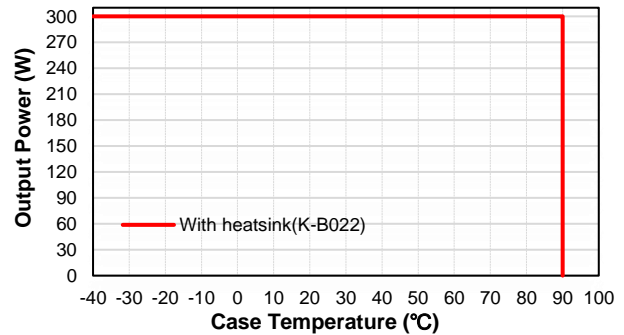
CHARACTERISTIC CURVE

Power Derating Curve

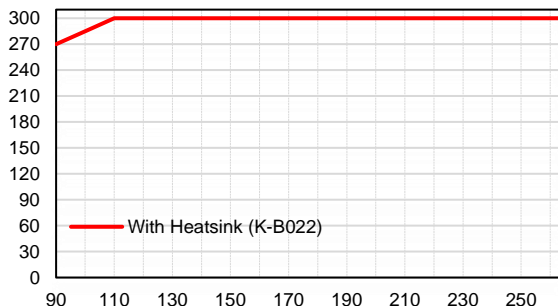
Output power vs Ambient Temperature (Ta)



Output power vs Case Temperature (Tc)

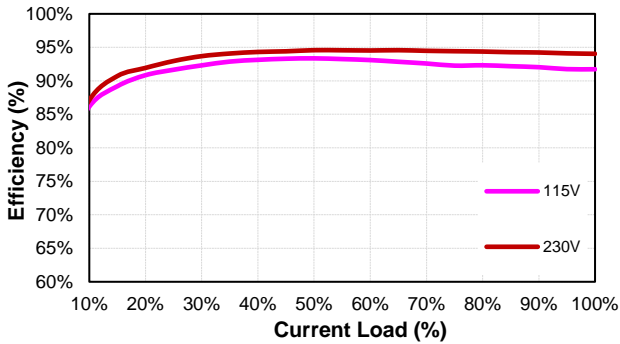


Output Power vs Input Voltage

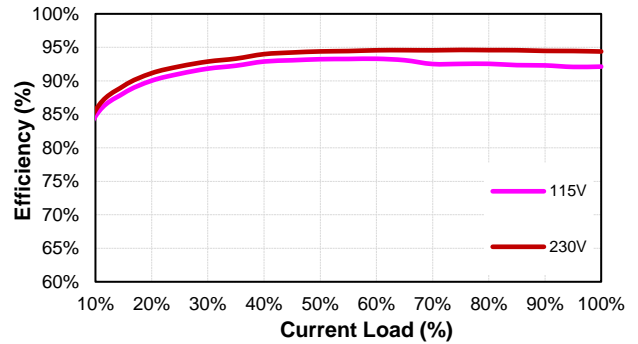


Performance Data

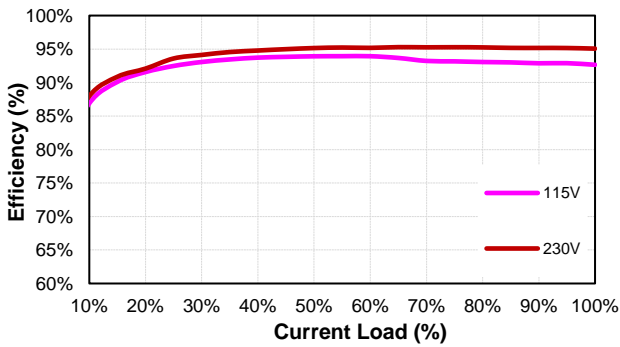
CBM300S120 (Eff Vs Io)



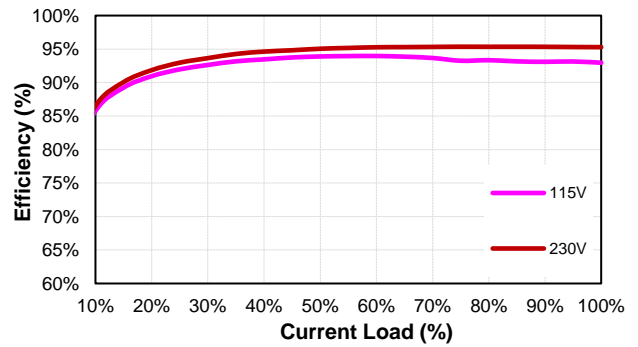
CBM300S150 (Eff Vs Io)



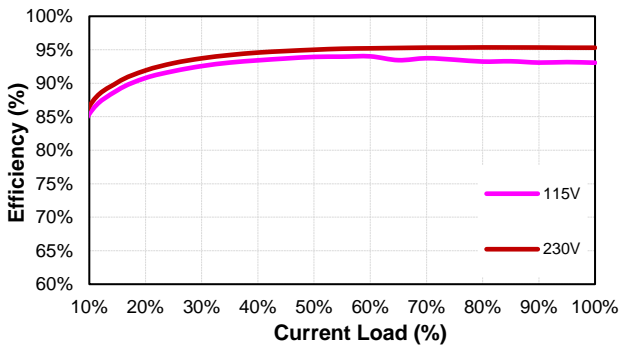
CBM300S240 (Eff Vs Io)



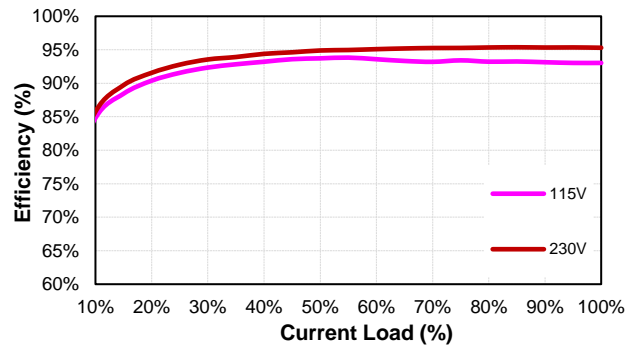
CBM300S280 (Eff Vs Io)



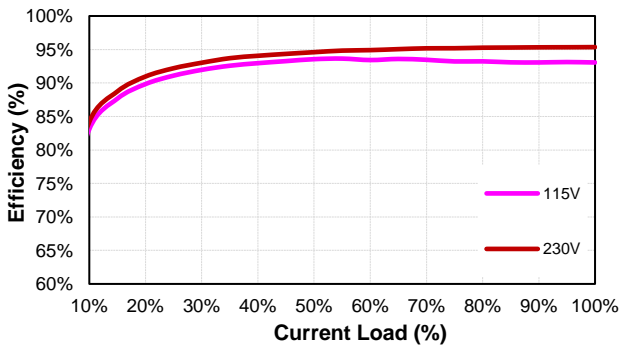
CBM300S360 (Eff Vs Io)



CBM300S480 (Eff Vs Io)



CBM300S540 (Eff Vs Io)

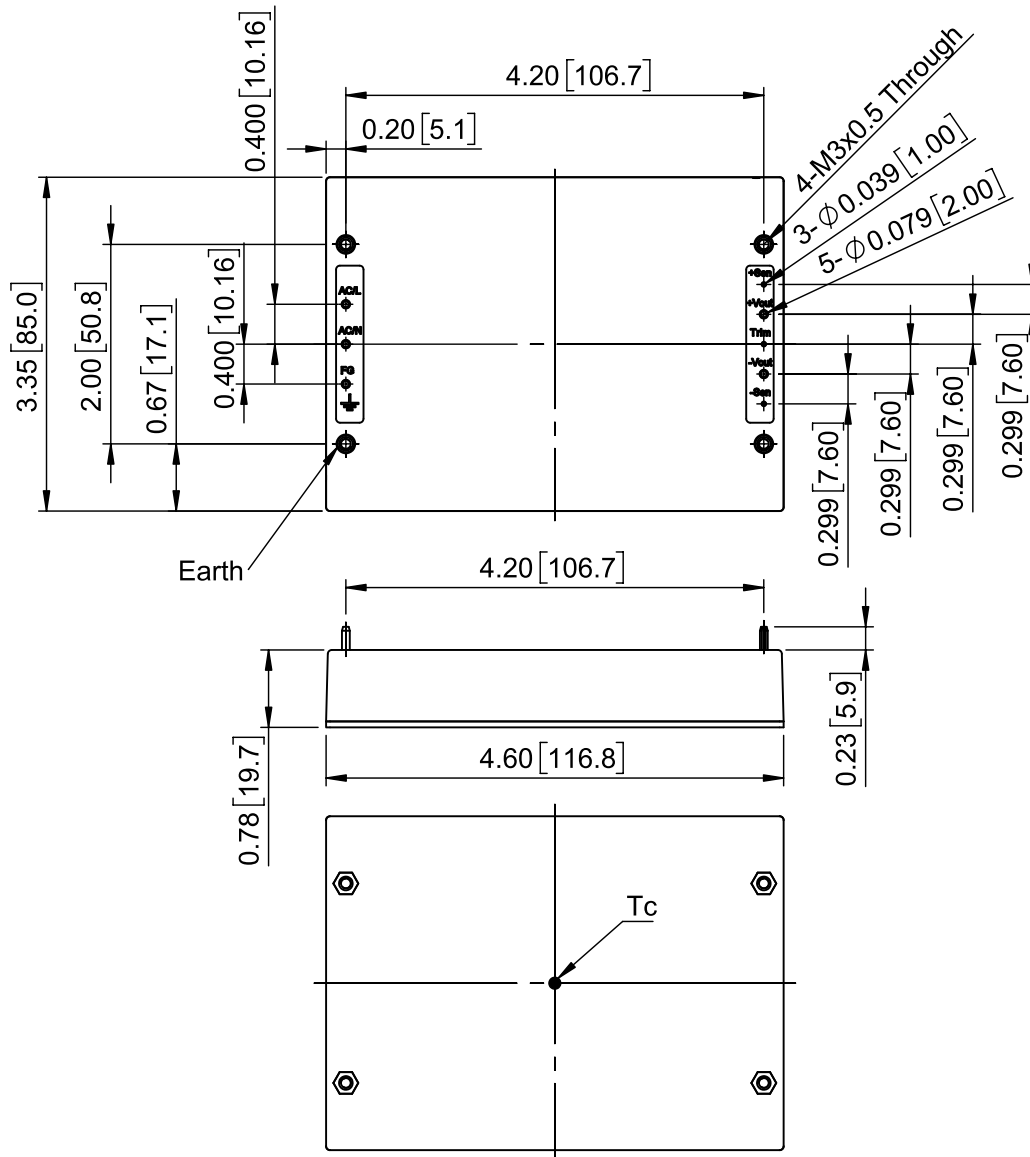


MECHANICAL SPECIFICATION

All Dimensions in Inches[mm]

Tolerance Inches: x.xx=±0.03, x.xxx=±0.020

Millimeters: x.x=±0.7, x.xx=±0.50



AC-DC Switching Brick Power Module
CBM300S Series
Application Note



Approved By:

Department	Approved By	Checked By	Written By
Research and Development Department	Ovid	Calvin	Red
Design Quality Department	Benny	JoJo	



CBM300S Series

Application Note V10 March 2025

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1. Introduction

This application note describes the features and functions of the CBM300S series, switching AC-DC brick power module. The CBM300S does not require any external 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 CBM300S series brick power module is extremely reliable.

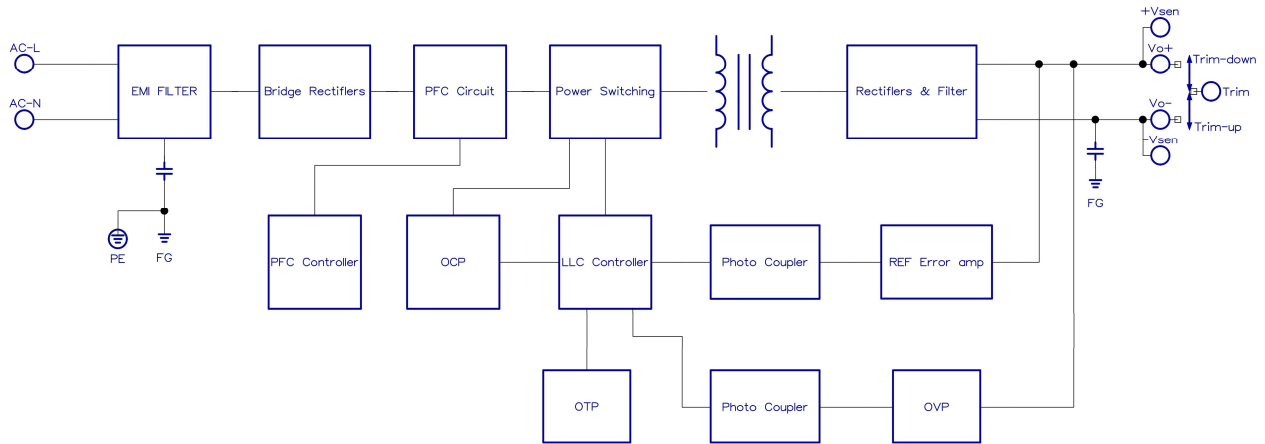
2. Pin Function Description



No	Label	Function	Description
1	AC/L	AC Line	Positive Supply Input
2	AC/N	AC Neutral	Negative Supply Input
3	FG	Mounting Insert	Mounting Insert (FG)
4	+Sen	+V Sense	Positive Power Output Sense
5	+Vout	+V Output	Positive Power Output
6	Trim	Trim	External Output Voltage Adjustment
7	-Vout	-V Output	Negative Power Output
8	-Sen	-V Sense	Negative Power Output Sense

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 CBM300S 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:

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

Where:

- V_1 is the output voltage at 60% load
- V_2 is the output voltage at 60%±40% load

The value of line regulation is defined as:

$$\text{Line reg.} = \frac{V_{HL} - V_{LL}}{V_{LL}} \times 100\%$$

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

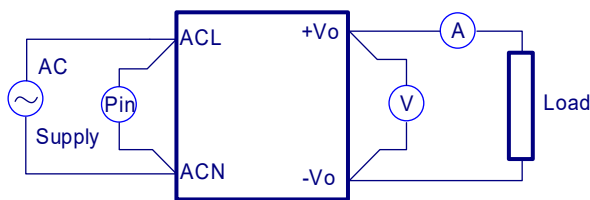


Figure 1. CBM300S Series Test Setup

5. Features and Functions

5.1 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.

5.2 Over Voltage Protection

All different voltage models have a fully continuous over voltage protection. The brick power module will supply OVP. In the event of happen the OVP, will go into latch off protection.

5.3 Over Temperature Protection

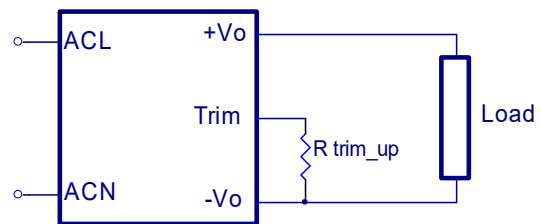
These modules have an over temperature protection circuit to safeguard against thermal damage. Shutdown occurs with the maximum case reference temperature is exceeded. The module will restart when the case temperature falls below over temperature recovery threshold. Please measure case temperature of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

5.4 Output Voltage Adjustment

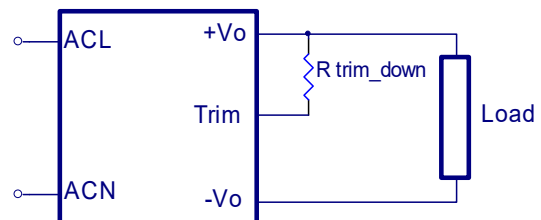
Output may be externally trimmed (-5% to +5%) with a fixed resistor. $P_o \leq \text{max. rated power}$, $I_o \leq I_{o,max.}$. Trim up/down is extra features, changing the output voltage will cause some electrical properties to be substandard.

Example:

Output voltage $\pm 1\%$, etc.



Trim-up Voltage Setup



Trim-down Voltage Setup

The value of R_{Trim_up} defined as:

$$R_{Trim_up} = \left[\frac{V_r * (R_1 + R_2) * R_3}{V_o * R_3 - V_r * (R_1 + R_2) - V_r * R_3} \right] - R_t (K\Omega)$$

Where:

R_{Trim_up} is the external resistor in $K\Omega$.

V_o is the desired output voltage.

R_1, R_2, R_3, R_t and V_r are internal to the unit and are defined in Table 1.

Table 1 – Trim up and Trim down Resistor Values

Model Name	Output Voltage(V)	R ₁ (KΩ)	R ₂ (KΩ)	R ₃ (KΩ)	R _T (KΩ)	V _r (V)
CBM300S120	12.0	24	1.8	6.8	1	2.5
CBM300S150	15.0	33	1	6.8	1	2.5
CBM300S240	24.0	51	7.5	6.8	1	2.5
CBM300S280	28.0	68	1.4	6.8	1	2.5
CBM300S360	36.0	82.5	8.66	6.8	1	2.5
CBM300S480	48.0	82.5	41.2	6.8	1	2.5
CBM300S540	54.0	110	30.1	6.8	1	2.5

For example, to trim-up the output voltage of 12V module (CBM300S120) by 5% to 12.6V, R_{Trim_up} is calculated as follows:

$R_1=24K\Omega, R_2=1.8K\Omega, R_3=6.8K\Omega, R_t=1K\Omega, V_r=2.5V, V_o=12.6V$

$$R_{Trim_up} = \frac{2.5 * (24 + 1.8) * 6.8}{12.6 * 6.8 - 2.5 * (24 + 1.8) - 2.5 * 6.8} - 1 = 103.93 (K\Omega)$$

The typical value of R_{Trim_up}

Trim up (%)	12V	15V	24V	28V	36V	48V	54V
	$R_{Trim_up} (K\Omega)$						
1%	477.82	565.67	627.63	652.99	659.02	614.96	656.56
2%	252.23	282.33	308.43	317.18	322.13	313.9	325.53
3%	171.14	187.89	204.22	209.23	212.93	210.52	216.19
4%	129.38	140.67	152.52	155.97	158.9	158.24	161.71
5%	103.93	112.33	121.63	124.24	126.65	126.68	129.08

The value of R_{Trim_down} defined as:

$$R_{Trim_down} = \left[\frac{V_o * R_3 * (R_1 + R_2) - V_r * R_3 * (R_1 + R_2)}{V_r * (R_1 + R_2) - V_o * R_3 + V_r * R_3} \right] - R_t (K\Omega)$$

Where:

R_{Trim_down} is the external resistor in $K\Omega$.

V_o is the desired output voltage.

R_1, R_2, R_3, R_t and V_r are internal to the unit and are defined in Table 1.

Table 1 – Trim up and Trim down Resistor Values

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CBM300S150	15.0	33	1	6.8	1	2.5
CBM300S240	24.0	51	7.5	6.8	1	2.5
CBM300S280	28.0	68	1.4	6.8	1	2.5
CBM300S360	36.0	82.5	8.66	6.8	1	2.5
CBM300S480	48.0	82.5	41.2	6.8	1	2.5
CBM300S540	54.0	110	30.1	6.8	1	2.5

For example, to trim-down the output voltage of 12V module (CBM300S120) by 5% to 11.4V, R_{Trim_down} is calculated as follows:

$R_1=24K\Omega, R_2=1.8K\Omega, R_3=6.8K\Omega, R_t=1K\Omega, V_r=2.5V, V_o=11.4V$

$$R_{Trim_down} = \frac{11.4 * 6.8 * (24 + 1.8) - 2.5 * 6.8 * (24 + 1.8)}{2.5 * (24 + 1.8) - (11.4 * 6.8) + (2.5 * 6.8)} - 1 = 391.32 (K\Omega)$$

The typical value of R_{Trim_down}

Trim down (%)	12V	15V	24V	28V
	$R_{Trim_down} (K\Omega)$			
1%	2297.36	2798.33	5027.08	5938.03
2%	1059.43	1381.67	2522.16	3010.69
3%	681.93	909.44	1670.31	2001.33
4%	499.15	673.33	1241.14	1490.11
5%	391.32	531.67	982.6	1181.25

Trim down (%)	36V	48V	54V
	$R_{Trim_down} (K\Omega)$		
1%	8061.44	12159.89	13042.68
2%	4066.24	5873.14	6495.37
3%	2698.73	3842.76	4293.21
4%	2008.06	2839.37	3188.39
5%	1591.42	2241.05	2524.3

6. Input / Output Considerations

6.1 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.

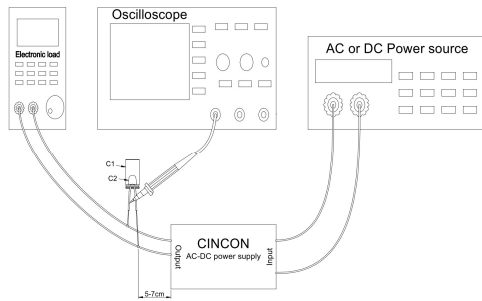


Figure 2. Output Voltage Ripple and Noise Measurement Set-Up

7. Thermal Design

7.1 Operating Temperature Range

The highly efficient design of the CBM300S series brick power module has resulted in their ability to operate within ambient temperature environments from -40°C to +80°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)

7.2 Convection Requirements for Cooling

To predict the approximate cooling needed for the brick power module, refer to the power derating curves in section 7.4. These derating curves are approximations of the ambient temperatures and airflows required to keep the brick 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).

7.3 Thermal Considerations

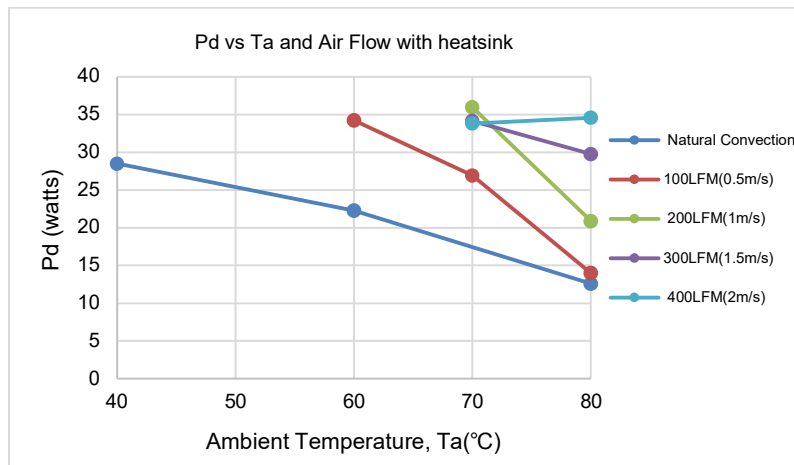
The brick power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. The example is presented in **section 7.4**. The power output of the module should not be allowed to exceed rated power ($V_{o_set} \times I_{o_max}$).

7.4 Power Derating

The operating case temperature range of CBM300S series is -40°C to +90°C (T_c). When operating the CBM300S series, proper derating or cooling is needed (at 110Vac). The maximum case temperature under any operating condition should not exceed 90°C (T_c).

The following curve is the derating curve of CBM300S series with heatsink.

Note: P_d is calculated after 1 minute of burn-in.



AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection	1.6 °C/W
100 ft./min. (0.5m/s)	0.8 °C/W
200 ft./min. (1.0m/s)	0.5 °C/W
300 ft./min. (1.5m/s)	0.3 °C/W
400 ft./min. (2.0m/s)	0.2 °C/W



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Example with heatsink (K-B022-A):

What is the minimum airflow necessary for a CBM300S120 operating at 110V_{ac}, an output current of 25A, and a maximum ambient temperature of 40°C with heatsink (K-B022-A)

Solution:

Given: $V_{in}=110V_{ac}$, $V_o=12V_{dc}$, $I_o=25A$

Determine power dissipation (P_d): $P_d=P_i-P_o=P_o(1-\eta)/\eta$, $P_d=12V \times 25A \times (1-0.912)/0.912=28.94\text{Watts}$

Determine airflow: Given: $P_d=28.94\text{W}$ and $T_a=40^\circ\text{C}$

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

Verify:

Maximum temperature rise is $\Delta T=P_d \times R_{ca}=28.94 \times 1.6=46.315^\circ\text{C}$

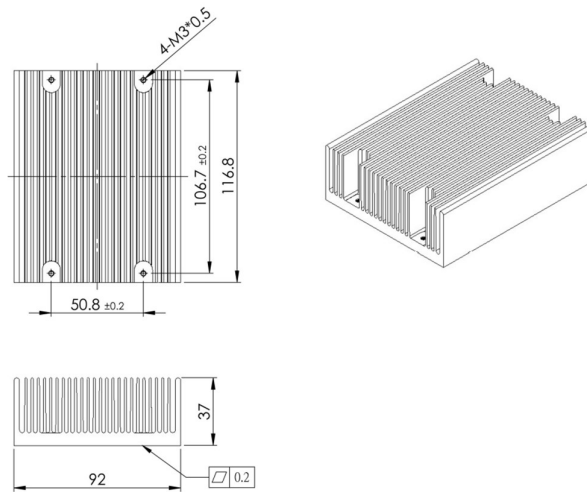
Maximum case temperature is $T_c=T_a+\Delta T=86.315^\circ\text{C}<90^\circ\text{C}$

Where:

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

T_a is ambient temperature and T_c is case temperature

8. Heat Sinks

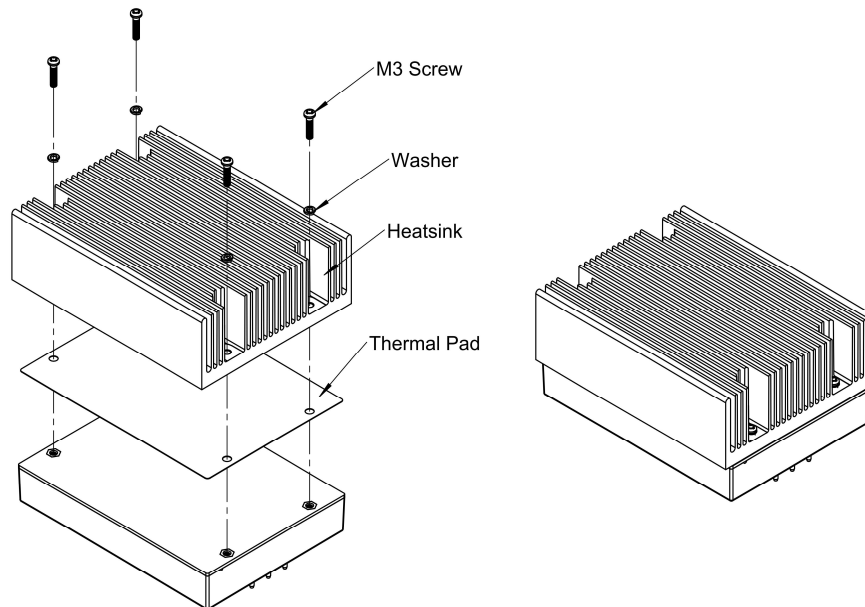


All Dimensions in mm

Heat Sink: 116.8*92*37mm (K-B022-A G6621281221)

Rca:

- 1.6°C/W (typ.), At natural convection
- 0.8°C/W (typ.), At 100LFM
- 0.5°C/W (typ.), At 200LFM
- 0.3°C/W (typ.), At 300LFM
- 0.2°C/W (typ.), At 400LFM



All Dimensions in mm

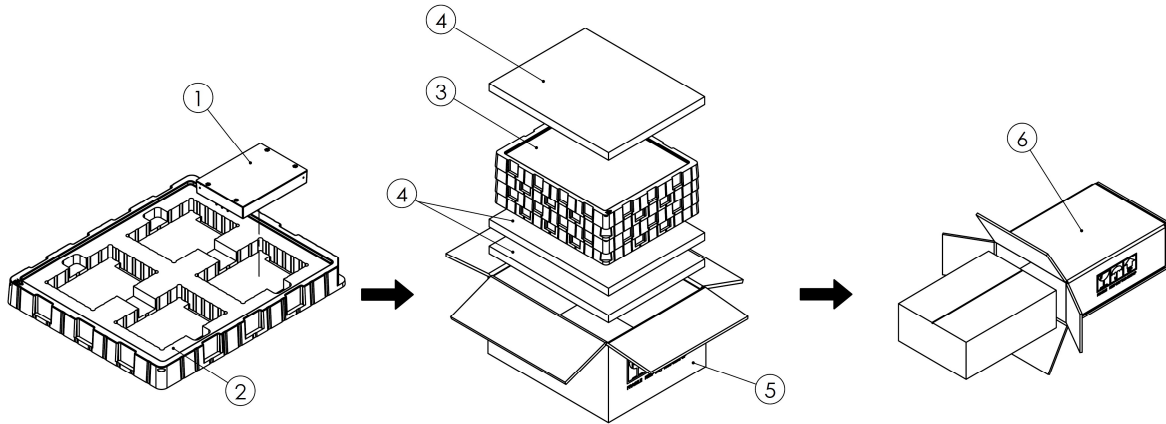
Heat Sink: 116.8*92*37mm (K-B022-A G6621281221)

Thermal pad: SR115.8*84*0.25mm (G61236RD304)

Screw SMP+SW M3*8L (G75A1300322)

9. Packing Information

CBM150S 40 PCS a box, including the total weight of package material about 14.6Kg



ITEM	PART NO.	NAME	OUTSIDE DIM(mm)	PCS
1	-	CBM300S Product	116x85x19.7	16
2	G64G20142	Antistatic Plastic blister	338.4x283.4x34.2	4
3	G64G20141	Antistatic Plastic blister	340x285x35	4
4	G64301087	Antistatic Foma	360x290x20	3
5	G64211308	No.114 Inner Cardboard Box	364x294x200	1
6	G64114293	No.114 Cardboard Box	400x320x225	1

Each Box Packaging 16 PCS Products
Gross weight Ref. 8.8 Kg