



100W DC-DC Half-Brick Regulated Single Output Converter

MHB100 series



■ Features :

- Half-brick size (2.28"X2.4"X0.5") with industry standard pin out
- 2:1 wide input range
- Protections: Short circuit / Over current / Over voltage / Over temperature
- High efficiency up to 89%
- 1500VDC I/O isolation
- Built-in remote ON/OFF control
- Built-in remote sense function
- Trimming output $\pm 10\%$
- Five-sided shield metal case
- Optional heat sinks for extended operating temperature
- Output 2.5V/3.3V/15V available
- Approvals: UL / CUL / CE
- 3 years warranty



SPECIFICATION

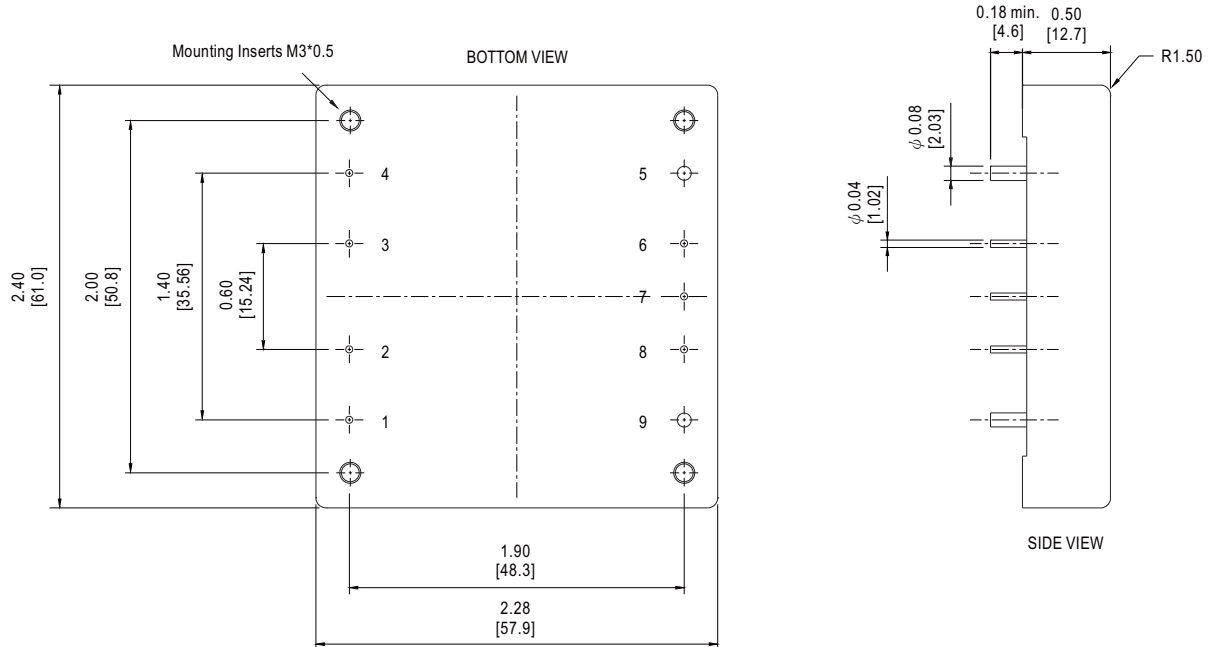
MODEL		MHB100-24S05	MHB100-24S12	MHB100-24S24	MHB100-48S05	MHB100-48S12	MHB100-48S24	
OUTPUT	DC VOLTAGE	5V	12V	24V	5V	12V	24V	
	CURRENT RANGE	0 ~ 20A	0 ~ 8.3A	0 ~ 4.17A	0 ~ 20A	0 ~ 8.3A	0 ~ 4.17A	
	RATED POWER	100W						
	RIPPLE & NOISE (max.) Note.2	100mVp-p	150mVp-p	240mVp-p	100mVp-p	150mVp-p	240mVp-p	
	VOLTAGE ACCURACY Note.3	±1.0%						
	LINE REGULATION	±0.2%						
	LOAD REGULATION	±0.2%						
	SWITCHING FREQUENCY (Typ.)	500KHz						
	EXTERNAL TRIM ADJ. RANGE (Typ.)	±10%						
EXTERNAL CAPACITIVE LOAD (max.)		20000uF	8300uF	4170uF	20000uF	8300uF	4170uF	
INPUT	RATED DC INPUT		24VDC			48VDC		
	VOLTAGE RANGE		18 ~ 36VDC			36 ~ 75VDC		
	SURGE VOLTAGE (100ms max.)		50VDC			100VDC		
	UNDER VOLTAGE LOCKOUT		Power up: 17VDC, Power down: 16VDC			Power up: 34VDC, Power down: 32.5VDC		
	EFFICIENCY (Typ.)		84%	87%	87%	86%	89%	88%
	DC CURRENT	FULL LOAD	5020mA	4880mA	4905mA	2480mA	2445mA	2465mA
		NO LOAD	50mA			50mA		
	FILTER		Pi-network					
PROTECTION	OUTPUT OVER CURRENT		110 ~ 140% rated output power Protection type : Over current limiting, recovers automatically after fault condition is removed					
	OUTPUT OVER VOLTAGE (Typ.)		115 ~ 140% rated output voltage Protection type : Output voltage clamp					
	OUTPUT SHORT CIRCUIT		Protection type : Can be continuous, recovers automatically after fault condition is removed					
	OVER TEMPERATURE		100℃ ±5℃ of case temperature					
FUNCTION OPERATING	REMOTE CONTROL		Please refer to "Remote ON/OFF Control" for details					
	OUTPUT TRIMMING		±10%, Please refer to "External Output Trimming" for details					
ENVIRONMENT	WORKING TEMPERATURE (Typ.)		-40 ~ +100℃ ; Thermal shutdown at 100℃ ±5℃ of case temperature (please refer to "Thermal Curve")					
	WORKING HUMIDITY		0% ~ 95% RH max.					
	STORAGE TEMP., HUMIDITY		-55 ~ +105℃, 0 ~ 95% RH					
	TEMP. COEFFICIENT		±0.03%/℃ (0~60℃)					
SAFETY & EMC (Note 4)	SAFETY STANDARDS		UL60950-1 approved					
	ISOLATION VOLTAGE		I/P-O/P:1500VDC, I/P-Case:1500VDC, O/P-Case:1500VDC					
	ISOLATION RESISTANCE		I/P-O/P:100M Ohms / 500VDC / 25℃ / 70% RH					
	EMC EMISSION		Compliance to EN55032 (CISPR32) Class A with external components (please refer to "EMC Suggestion Circuit")					
OTHERS	EMC IMMUNITY		Compliance to EN61000-4-2,3,4,5,6,8; EN55024, light industry level, criteria A					
	CASE MATERIAL		Aluminum					
	MTBF		900K hrs typ. MIL-HDBK-217F (25℃)					
	DIMENSION		57.9*61*12.7mm (2.28**2.40**0.5") (L*W*H)					
NOTE	WEIGHT		95g					
	1. All parameters NOT specially mentioned are measured at 24,48VDC input, rated load and 25℃ of ambient temperature. 2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 1uf ceramic & 10uf tantalum capacitor across output. 3. The power supply need to connect "+Vout" to "+R.S" and "-Vout" to "-R.S". 4. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives. For guidance on how to perform these EMC tests, please refer to "EMI testing of component power supplies."							

Mechanical Specification

Unit:inch[mm]

All Dimensions In Inches [mm]

Tolerance Inches: X.XX= ± 0.02 , X.XXX= ± 0.010

Millimeters: X.X= ± 0.5 , X.XX= ± 0.25


Pin No. Assignment

Pin No.	Assignment	Pin No.	Assignment	Pin No.	Assignment
1	+Vin	4	-Vin	7	Trim
2	R.C.	5	-Vout	8	+R.S.
3	Case	6	-R.S.	9	+Vout

Remote ON/OFF Control

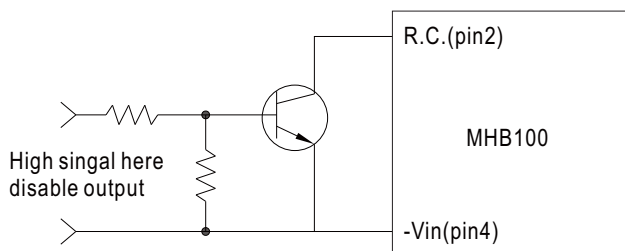
The MHB100 series allow the user to switch the power ON and OFF electronically by their remote ON/OFF feature. The MHB100 series are available with "Positive Logic" (standard) or "Negative Logic" (option).

Logic table

Logic State(pin2)	Positive logic	Negative logic
Logic Low-Switch Closed	Power OFF(<0.8Vdc)	Power ON(<0.8Vdc)
Logic High-Switch Open	Power ON(Open circuit)	Power OFF(Open circuit)

Note: 1.Logic compatibility : R.C.(pin2) ~ -Vin(pin4).

2.Suffix "N" to the model number with Negative logic remote ON/OFF.



Example control circuit(positive logic)

External Output Trimming

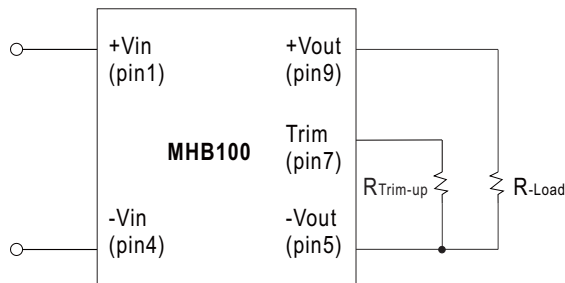


Figure 1 : Trim-up voltage setup

The value of $R_{Trim-up}$ defined as:

$$R_{Trim-up} = \frac{(R1-R2 \times (V_o - V_{o,nom}))}{(V_o - V_{o,nom})} (K\Omega)$$

Where: $R_{Trim-up}$ is the external resistor in Kohm.

$V_{o,nom}$ is the nominal output voltage.

V_o is the desired output voltage.

$R1$ and $R2$ are inside the unit and list in Table 1

Output Voltage(V)	R1 (Kohm)	R2 (Kohm)
5V	5.8	3.3
12V	18.945	4.636
24V	41.442	6.977

Table 1

For example, to Trim-up the output

voltage of 5.0V model (MHB100-48S05)

by 8% to 5.4V, $R_{Trim-up}$ is calculated

as follows:

$$V_o - V_{o,nom} = 5.4 - 5.0 = 0.4V$$

$$R1 = 5.8 \text{ Kohm}$$

$$R2 = 3.3 \text{ Kohm}$$

$$R_{Trim-up} = \frac{5.8 - 3.3 \times 0.4}{0.4} = 11.2 (K\Omega)$$

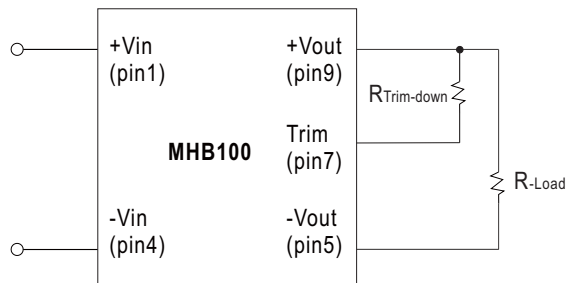


Figure 2 : Trim-down voltage setup

The value of $R_{Trim-down}$ defined as:

$$R_{Trim-down} = \frac{(R1 - R2 \times (V_o, nom - V_o))}{(V_o, nom - V_o)} (K\Omega)$$

Where: $R_{Trim-down}$ is the external resistor in Kohm.

$V_{o,nom}$ is the nominal output voltage.

V_o is the desired output voltage.

$R1$ and $R2$ are inside the unit and list in Table 2.

Output Voltage(V)	R1 (Kohm)	R2 (Kohm)
5V	5.8	5.32
12V	86.45	60.1
24V	430	120

Table 2

For example, to Trim-down the output

Voltage of 5.0V model (MHB100-48S05)

by 8% to 4.6V, $R_{Trim-down}$ is

calculated as follows :

$$V_{o,nom} - V_o = 5.0 - 4.6 = 0.4 V$$

$$R1 = 5.8 \text{ Kohm}$$

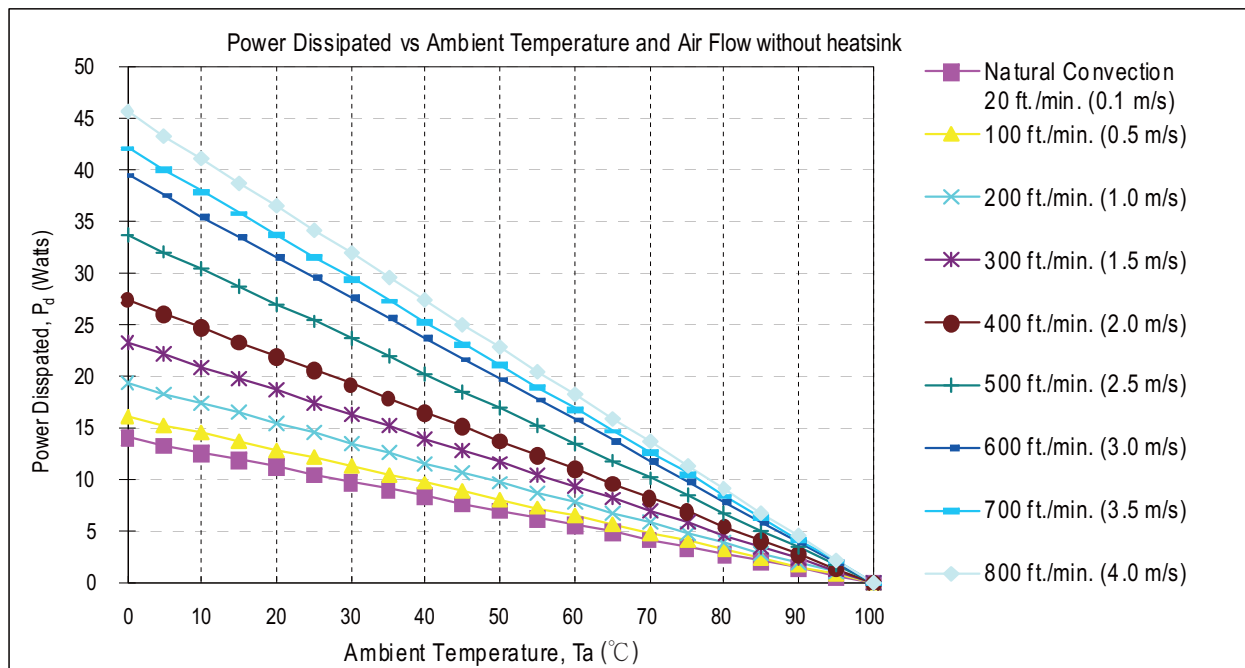
$$R2 = 5.32 \text{ Kohm}$$

$$R_{Trim-down} = \frac{5.8 - 5.32 \times 0.4}{0.4} = 9.18 (K\Omega)$$

Thermal Curve

The operating case temperature range of MHB-100 series is -40°C to +100°C. When operate the MHB-100 series, proper de-rating or cooling is needed.

The maximum case temperature under any operating condition should not be exceed 100°C. The following curve is the de-rating curve of MHB-100 series without heat sink.



Air Flow Rate	Typical Rca	Air Flow Rate	Typical Rca
Natural convection 20ft./min. (0.1m/s)	7.12°C/W	500 ft./min. (2.5m/s)	2.96°C/W
100 ft./min. (0.5m/s)	6.21°C/W	600 ft./min. (3.0m/s)	2.53°C/W
200 ft./min. (1.0m/s)	5.17°C/W	700 ft./min. (3.5m/s)	2.37°C/W
300 ft./min. (1.5m/s)	4.29°C/W	800 ft./min. (4.0m/s)	2.19°C/W
400 ft./min. (2.0m/s)	3.64°C/W		

Rca : Thermal resistance from case to ambience

Example:

What is the minimum airflow necessary for a MHB100-48S12 operates at nominal line, an output current of 8.3A, and a maximum ambient temperature of 40°C?

Solution:

Given: $V_{in}=48Vdc$, $V_o=12Vdc$, $I_o=8.3A$, η (unit efficiency)=89%

Determine Power dissipation (P_d):

$$P_d = P_i - P_o = P_o(1 - \eta) / \eta$$

$$P_d = 12 \times 8.3 \times (1 - 0.89) / 0.89 = 12.31 \text{ Watts}$$

Determine airflow:

Given: $P_d=12.31W$ and $T_a=40^\circ C$

Check Thermal Curve above:

minimum airflow= 300 ft./min.

Verifying: The maximum temperature rise $\Delta T = P_d \times Rca = 12.31 \times 4.29 = 52.8^\circ C$

The maximum case temperature $T_c = T_a + \Delta T = 92.8^\circ C < 100^\circ C$

Where: The Rca is thermal resistance from case to ambience.

The T_a is ambient temperature and the T_c is case temperature.

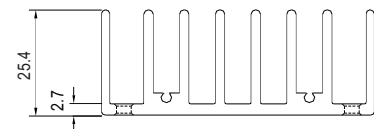
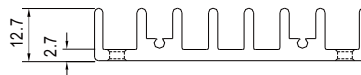
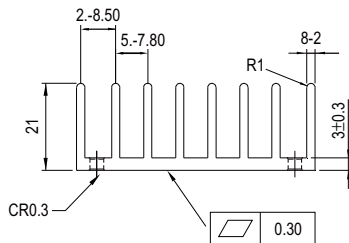
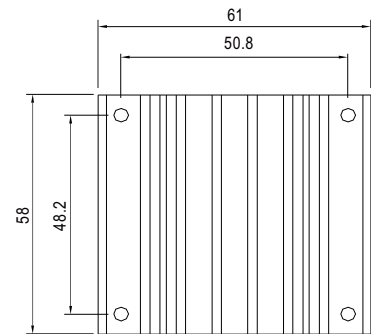
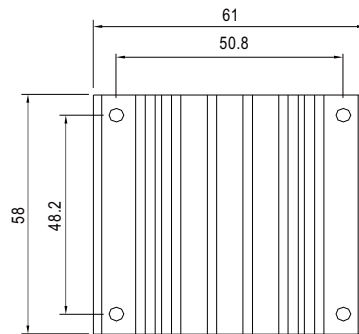
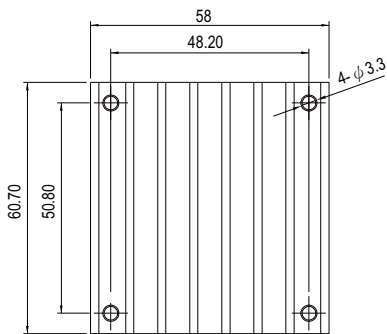
■ Case Heat Sink (Optional)

Unit:mm

Model No.: M-C308 (Vertical Fins)

Model No.: M-C091(Horizontal Fins)

Model No.: M-C092 (Horizontal Fins)



Rca:

3.90°C/W (typ.), at natural convection
 1.74°C/W (typ.), at 100ft./min.(LFM)
 1.33°C/W (typ.), at 200ft./min.(LFM)
 1.12°C/W (typ.), at 300ft./min.(LFM)
 0.97°C/W (typ.), at 400ft./min.(LFM)

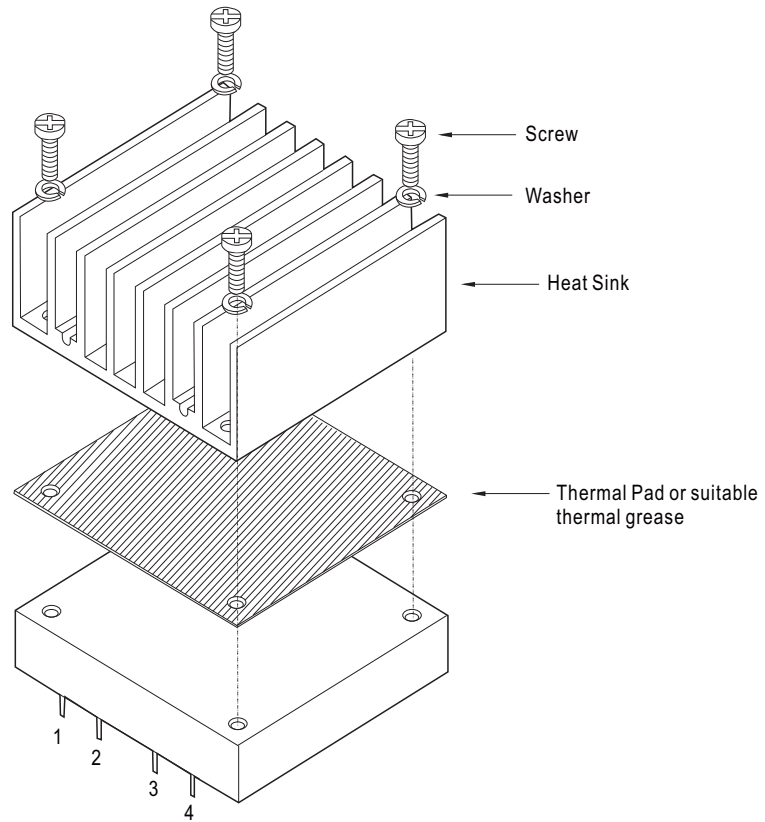
Rca:

4.70°C/W (typ.), at natural convection
 2.89°C/W (typ.), at 100ft./min.(LFM)
 2.30°C/W (typ.), at 200ft./min.(LFM)
 1.88°C/W (typ.), at 300ft./min.(LFM)
 1.59°C/W (typ.), at 400ft./min.(LFM)

Rca:

3.00°C/W (typ.), at natural convection
 1.44°C/W (typ.), at 100ft./min.(LFM)
 1.17°C/W (typ.), at 200ft./min.(LFM)
 1.04°C/W (typ.), at 300ft./min.(LFM)
 0.95°C/W (typ.), at 400ft./min.(LFM)

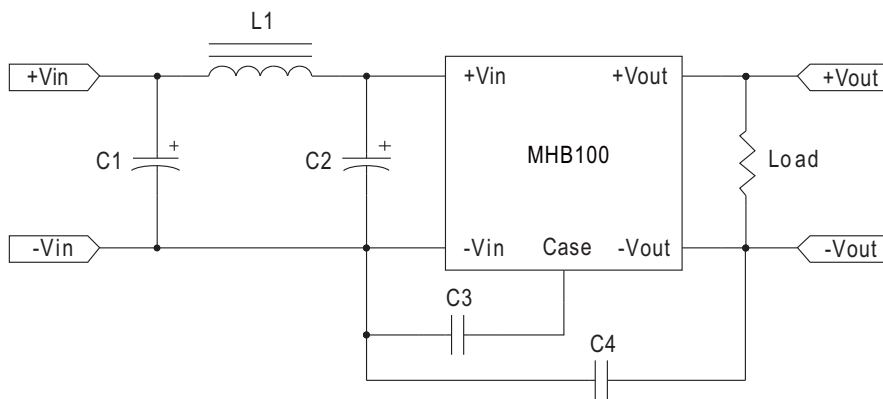
Heatsink Assembly



Heat Sink Order No.:
M-C308
M-C091
M-C092
Thermal Pad: 56.9x60x0.25mm
Screw: SMP+SW M3x8L

EMC Suggestion Circuit

※Required external components to meet EN55022 class A conducted emission are as below:



Model No.	C1	C2	C3	C4	L1
MHB100-24S□	220uF/50V ESR<0.13Ω	220uF/50V ESR<0.13Ω	2200pF	N.C	3.4uH
MHB100-48S□	47uF/100V ESR<0.17Ω	47uF/100V ESR<0.17Ω	1000pF	1000pF	3.4uH

□ =05,12,24