

## HALF-BRICK DC-DC CONVERTERS

4:1 WIDE INPUT RANGE UP TO 200 WATTS

RAILWAY APPLICATIONS

HWB200 SERIES



### FEATURES

- Railway System Applications
- Meets: EN50155, EN50121-3 and EN61373
- 4:1 Ultra Wide Input Range
- No Minimum Load Required
- High Efficiency Up to 91%
- Remote Control
- 2250Vdc Basic Insulation (24 and 48Vin)
- Half Brick 2.28" × 2.40" × 0.50" Package
- UL60950-1, EN60950-1, IEC60950-1 Safety Approvals
- CE Marked
- Compliant to RoHS & Reach

### SELECTION GUIDE

All specifications are typical at nominal input, full load and 25°C, unless otherwise noted.

Input Voltage Range Vdc	Output Voltage Vdc	Output Current at Full Load A	Input Current at No Load mA	Efficiency %	*Model Number	Maximum Capacitor Load µF
9 ~ 36	3.3	50	25	87	HWB200-12S3P3	151000
9 ~ 36	5	36	90	90	HWB200-12S05	72000
8.5 ~ 36	12	15	90	90	HWB200-12S12	12500
8.5 ~ 36	15	12	55	90	HWB200-12S15	8000
8.5 ~ 36	24	7.5	70	90	HWB200-12S24	3100
8.5 ~ 36	28	6.5	55	90	HWB200-12S28	2300
8.5 ~ 36	48	3.7	75	89	HWB200-12S48	770
16.5 ~ 75	3.3	50	20	88	HWB200-24S3P3	151000
16.5 ~ 75	5	40	35	91	HWB200-24S05	80000
16.5 ~ 75	12	18	45	91	HWB200-24S12	15000
16.5 ~ 75	15	15	45	91	HWB200-24S15	10000
16.5 ~ 75	24	9	40	93	HWB200-24S24	3700
16.5 ~ 75	28	7.5	50	93	HWB200-24S28	2600
16.5 ~ 75	48	4.5	50	91	HWB200-24S48	930
43 ~ 160	3.3	60	20	90	HWB200-48S3P3	181000
43 ~ 160	5	46	20	91	HWB200-48S05	92000
43 ~ 160	12	21	25	91	HWB200-48S12	17500
43 ~ 160	15	17	25	93	HWB200-48S15	11300
43 ~ 160	24	10.5	25	92	HWB200-48S24	4300
43 ~ 160	28	9	25	92	HWB200-48S28	3200
43 ~ 160	48	5.2	25	92	HWB200-48S48	1000

\* All standard units are negative Remote ON/OFF control logic.  
For positive Remote ON/OFF control logic, use Suffix "P"

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Input Specifications		
Operating input voltage range, Vdc	9 Min., 24 Typ., 36 Max.	24Vin(nom), 3.3 & 5Vout
	8.5 Min., 24 Typ., 36 Max.	Others
	16.5 Min., 48 Typ., 75 Max.	48Vin(nom)
	43 Min., 110 Typ., 160 Max.	110Vin(nom)
Start up voltage, Vdc	9 Max.	24Vin(nom)
	18 Max.	48Vin(nom)
	43 Max.	110Vin(nom)
Shutdown voltage, Vdc	7.3 Min., 8.1 Max.	24Vin(nom)
	15.5 Min., 16.3 Max.	48Vin(nom)
	33.0 Min., 36.0 Max.	110Vin(nom)
Start up time, ms		Constant resistive load
	75 Typ.	Power up
	75 Typ.	Remote ON/OFF
Input surge voltage, Vdc		1 second, max.
	50 Max.	24Vin(nom)
	100 Max.	48Vin(nom)
	185 Max.	110Vin(nom)
Input filter <sup>(1)</sup>	Pi type	
Remote ON/OFF		Referred to -Vin pin
	Short or 0 - 1.2 Vdc	Negative logic, DC-DC ON (Standard), no Suffix
	Open or 3 - 12 Vdc	DC-DC OFF
	Open or 3 - 12 Vdc	Positive logic, DC-DC ON (Option), Suffix "P"
	Short or 0 - 1.2 Vdc	DC-DC OFF
	-0.5 Min., 1 Max., mA	Input current of Ctrl pin
	3mA Typ.	Remote off input current
Sync pin signal <sup>(2)</sup> , Vdc	-0.3 Min., 5.6 Max.	

Output Specifications		
Voltage accuracy, %	-1 Min., +1 Max.	
Line regulation, %	-0.1 Min., +0.1 Max.	Low Line to High Line at Full Load
Load regulation, %	-0.1 Min., +0.1 Max.	No Load to Full Load
Voltage and adjustability, %	-20 Min., +10 Max.	Maximum output deviation is inclusive of remote sense
Remote sense, %	10 Max.	% of Vout(nom), If remote sense is not being used, Sense pins should be connected to corresponding polarity OUTPUT pins.
Ripple and noise, mVp-p		Measured by 20MHz bandwidth
	75 Typ.	With a 1µF/25V X7R MLCC and a 22µf/25V POS-CAP, 3.3Vout, 5Vout
	100 Typ.	With a 1µF/25V X7R MLCC and a 22µf/25V POS-CAP, 12Vout, 15Vout
	200 Typ.	With a 4.7µF/50V X7R MLCC, 24Vout, 28Vout
	300 Typ.	With a 2.2µF/100V X7R MLCC, 48Vout, 53Vout
Temperature coefficient, %/°C	-0.02 Min., +0.02 Max.	
Transient response recovery time, µs	200 Typ., 250 Max.	25% load step change
Over voltage protection, %	115 Min., 130 Max.	% of Vout(nom); Hiccup mode
Over load protection, %	120 Min., 150 Max.	% of Iout rated; Hiccup mode, 110Vin(nom)
Short circuit protection	Continuous, automatic recovery	

General Specifications				
Isolation voltage, Vdc	1 minute (Basic insulation)	Input to Output	2250 Min.	
	1 minute (Basic insulation)	Input (Output) to Case	1600 Min.	
Isolation resistance, GΩ	500Vdc		1 Min.	
Isolation capacitance, pF				2500 Max.
Switching frequency, kHz			225 Min.	250 Typ. 275 Max.

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Environmental Specifications			
Operating case temperature, °C		-40 Min.	+115 Max.
Over temperature protection, °C			+120 Typ.
Storage temperature range, °C	Terminal block type	-40 Min.	+105 Max.
	Others	-55 Min.	+125 Max.
Thermal impedance <sup>(3)</sup> , °C/W	Vertical direction by natural convection (20LFM)		
	Module without assembly option		6.1 Typ.
	Only mount on the iron base-plate		2.8 Typ.
	Heat-sink type with 0.24" Height		5.1 Typ.
	Heat-sink type with 0.45" Height		4.6 Typ.
Thermal shock		MIL-STD-810F	
Vibration		MIL-STD-810F	
Relative humidity		5% to 95% RH	

Physical Specifications		EMC Specifications			
Design meet safety standard	UL60950-1, EN60950-1, IEC60950-	Specifications	Conditions	Level	
Case material	Metal	EMI <sup>(3)</sup>	EN55022	Class A	
Base material	FR4 PCB			Class B	
Potting material	Silicone (UL94 V-0)	ESD	EN61000-4-2	Air ±8kV and Contact ±6kV	Perf. Criteria A
Weight	105g (3.7oz)	Radiated immunity	EN61000-4-3	20V/m	Perf. Criteria A
MTBF	3.182×10 <sup>5</sup> hrs, MIL-HDBK-217F, Full load	Fast transient <sup>(4)</sup>	EN61000-4-4	±2kV	Perf. Criteria A
Dimensions	2.28" × 2.40" × 0.50"	Surge <sup>(4)</sup>	EN61000-4-5	EN55024 ±2kV	Perf. Criteria A
		Conducted immunity	EN61000-4-6	10Vr.m.s	Perf. Criteria A

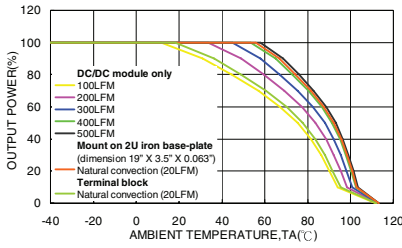
### Note:

1. Input source impedance: The power modules will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module. Since real-world voltage source has finite impedance, performance can be improved by adding external filter capacitor. Recommended Nippon Chemi-con KY series, 100µF/100V.
2. (1)Multiple HWB200 series module can be synchronized together simply by connecting Sync pins together. Care should be taken to ensure the ground potential differences between modules are minimized.  
(2)In this configuration all of the modules will be synchronized to the highest frequency module.  
(3)Up to three modules can be synchronized using this technique.  
(4)More relevant information in datasheet.
3. (1)Thermal test condition with vertical direction by natural convection (20LFM).  
(2)The iron base-plate dimension is 19" X 3.5" X 0.063" (The height is EIA standard 2U).  
(3) The heat-sink is optional and P/N: 7G-0021A-F , 7G-0022A-F , 7G-0023A-F , 7G-0024A-F. Please refer to heat-sink selection guide.
4. The HWB200 series standard module meets EN55022 Class A and Class B with external components.
5. An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. Recommended 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220µF/100V) to connect in parallel.
6. CASE GROUNDING Connecting four screw bolts to shield plane will help to reduce the EMI.
7. For further information, please contact Polytron Devices.

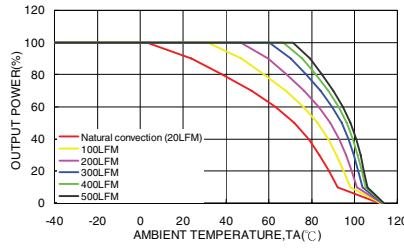
**CAUTION:** This power module is not internally fused. An input line fuse must always be used.

# HWB200 SERIES

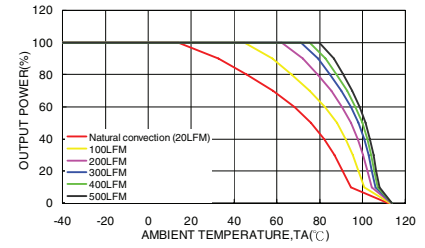
## Characteristic Curve



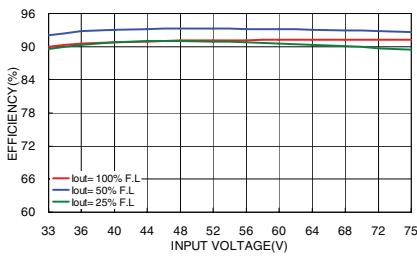
HWB200-48S05 Derating Curve (Note 2)



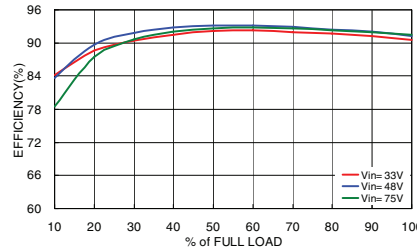
HWB200-48S05 Derating Curve (Note 2)  
With 0.24" Height Heat-sink



HWB200-48S05 Derating Curve (Note 2)  
With 0.45" Height Heat-sink

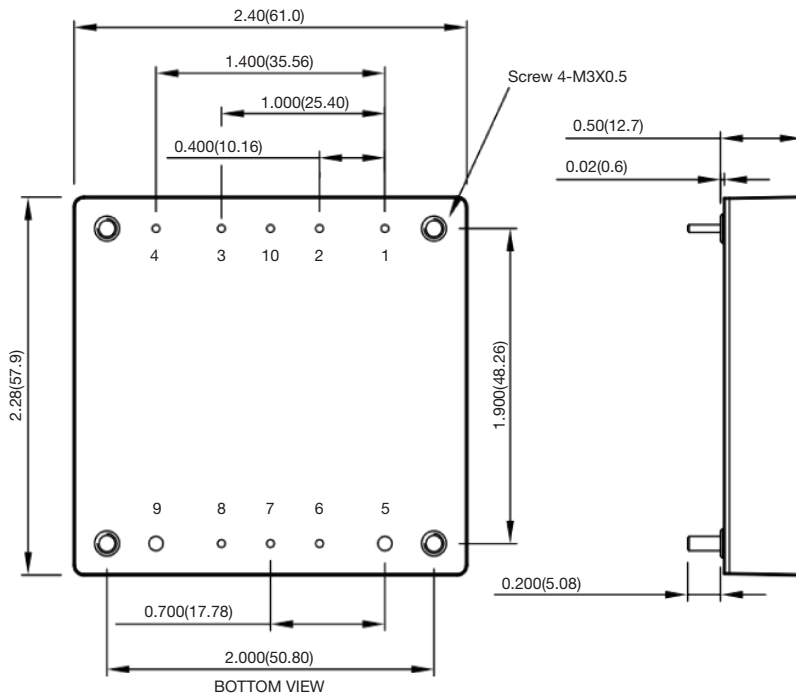


HWB200-48S05 Efficiency vs. Input Voltage



HWB200-48S05 Efficiency vs. Output Load

## Mechanical Drawing



1. All dimensions in inch (mm)
2. Tolerance:  $x.xx \pm 0.02$  ( $x.x \pm 0.5$ )  
 $x.xxx \pm 0.01$  ( $x.xx \pm 0.25$ )
3. Pin pitch tolerance  $\pm 0.01$  (0.25)
4. Pin dimension tolerance  $\pm 0.004$  (0.1)

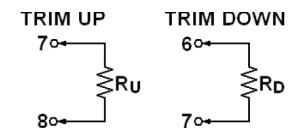
5. Mounting screws should always be used.
6. The screw locked torque: **MAX 5.0kgf-cm(0.49N-m)**

### PIN CONNECTION

PIN	DEFINE	DIAMETER
1	-Vin	0.04 Inch
2	Case (option)	0.04 Inch
3	Ctrl	0.04 Inch
4	+Vin	0.04 Inch
5	-Vout	0.08 Inch
6	-Sense	0.04 Inch
7	Trim	0.04 Inch
8	+Sense	0.04 Inch
9	+Vout	0.08 Inch
10	Sync (option)	0.04 Inch

### EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below.



$$R_U = \left( \frac{V_{OUT} (100 + \Delta\%)}{1.225 \Delta\%} - \frac{(100 + 2\Delta\%)}{\Delta\%} \right) k\Omega$$

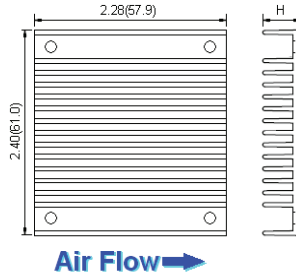
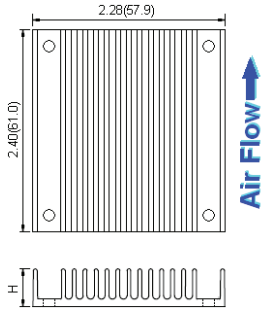
$$R_D = \left( \frac{100}{\Delta\%} - 2 \right) k\Omega$$

## HWB200 SERIES

### Heat-Sink Type Options

Vertical Fin Orientation, Suffix: -HS, -HS2

Horizontal Fin Orientation, Suffix: -HS1, -HS3



HS	Height H=0.45" vertical fin, 7G-0021A-F
HS1	Height H=0.24" horizontal fin, 7G-0022A-F
HS2	Height H=0.24" vertical fin, 7G-0023A-F
HS3	Height H=0.45" horizontal fin, 7G-0024A-F

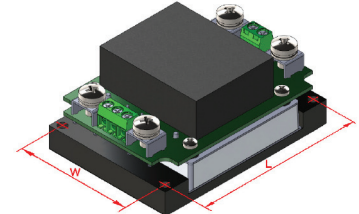
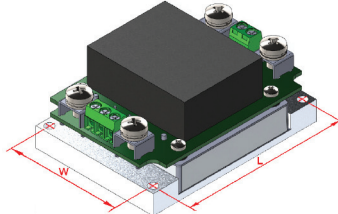
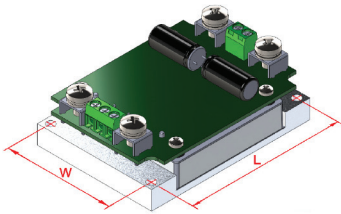
1. All dimensions in inch (mm)
2. Tolerance :  $x.xx \pm 0.02$  ( $x.x \pm 0.5$ )  
 $x.xxx \pm 0.01$  ( $x.xx \pm 0.25$ )

### Terminal Block Type Option

Wall mounted, Suffix: -T

Wall mounted with EMC Filter, Suffix: -TF

Wall mounted with EMC Filter, Suffix: -TF1  
(Can be connected to PE)



Terminal block type	-T	-TF	-TF1
Weight	235g (8.29oz)	280g (9.88oz)	287g (10.12oz)
Dimensions	3.35 x 2.40 x 1.27 inch (85.0 x 61.0 x 32.3 mm)	3.35 x 2.40 x 1.47 inch (85.0 x 61.0 x 37.3 mm)	3.35 x 2.40 x 1.53 inch (85.0 x 61.0 x 38.8 mm)
Through hole (WxL)	2.126 x 3.071 inch (54.00 x 78.00 mm), 4- $\varnothing$ 0.17 inch ( $\varnothing$ 4.3mm)		

For further information, please contact Polytron Devices.