

## HALF-BRICK DC-DC CONVERTERS

### 4:1 ULTRA WIDE INPUT RANGE 150 WATT

#### RAILWAY APPLICATIONS

#### HWB150 SERIES



#### FEATURES

- No Minimum Load Required
- 2250Vdc Input to Output Basic Insulation
- Railway Applications
- 4:1 Wide Input Voltage Range
- (9-36, 8.5-36, 16.5- 75 and 43-160Vdc)
- High Efficiency Up to 91%
- Adjustable Output Voltage
- Remote Control
- Sync (Option)
- Under Voltage Protection
- Output Current Protection
- Short Circuit Protection
- Over Voltage Protection
- Over Temperature Protection
- Industry Standard Half Brick Footprint
- Terminal Block Option
- Heat Sink Option
- Safety Meets UL60950-1, EN60950-1 and EN50155
- CE Mark Meets 2006/95/EC, 2011/95/EC and 2004/108/EC
- Compliant to RoHS EU Directive 2011/65/EU and REACH
- Dimensions: 2.28" × 2.40" × 0.50"

#### 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	40	20	88	HWB150-24S3P3	121000
9 - 36	5	28	25	90	HWB150-24S05	56000
8.5 - 36	12	12	25	90	HWB150-24S12	10000
8.5 - 36	15	9.5	25	91	HWB150-24S15	6300
8.5 - 36	24	6	25	90	HWB150-24S24	2500
8.5 - 36	28	5	25	90	HWB150-24S28	1700
8.5 - 36	48	3	35	90	HWB150-24S48	620
16.5 - 75	3.3	40	15	89	HWB150-48S3P3	121000
16.5 - 75	5	30	15	91	HWB150-48S05	60000
16.5 - 75	12	13	20	91	HWB150-48S12	10800
16.5 - 75	15	10	20	91	HWB150-48S15	6600
16.5 - 75	24	6.5	20	91	HWB150-48S24	2700
16.5 - 75	28	5.5	20	91	HWB150-48S28	1900
16.5 - 75	48	3.2	25	91	HWB150-48S48	660
43 - 160	3.3	43	10	88	HWB150-110S3P3	130000
43 - 160	5	32	10	90	HWB150-110S05	64000
43 - 160	12	15	10	90	HWB150-110S12	12500
43 - 160	15	12	10	90	HWB150-110S15	8000
43 - 160	24	7.5	10	90	HWB150-110S24	3100
43 - 160	28	6.5	10	90	HWB150-110S28	2300
43 - 160	48	3.8	10	90	HWB150-110S48	790

## HWB150 SERIES

Input Specifications			Output Specifications		
Operating input voltage range, Vdc	9 Min., 24 Typ., 36 Max.	24Vin(nom), 3.3 & 5Vout	Voltage accuracy, %	-1.0 Min., +1.0 Max.	
	8.5 Min., 24 Typ., 36 Max.	Others	Line regulation, %	-0.1 Min., +0.1 Max.	Low Line to High Line at Full Load
	16.5 Min., 48 Typ., 75 Max.	48Vin(nom)	Load regulation, %	-0.1 Min., +0.1 Max.	No Load to Full Load
	43 Min., 110 Typ., 160 Max.	110Vin(nom)	Voltage and adjustability, %	-20 Min., +10 Max.	
Start up voltage, Vdc	9 Max.	24Vin(nom)	Remote sense, %	10 Max.	Maximum output deviation is inclusive of remote sense % of Vout(nom) If remote sense is not being used, Sense pins should be connected to correspondina polarity OUTPUT pins.
	18 Max.	48Vin(nom)			
	43 Max.	110Vin(nom)			
Shutdown voltage, Vdc	7.3 Min.	24Vin(nom)	Ripple and noise, mVp-p	75 Typ.	Measured by 20MHz bandwidth With a 1µF/25V X7R MLCC and a 22µF/25V POS-CAP, 3.3Vout, 5Vout
	15.5 Min.	48Vin(nom)			
	33.0 Min.	110Vin(nom)			
Start up time, ms	75 Typ.	Constant resistive load, Power up			
	75 Typ.	Remote ON/OFF			
Input surge voltage, Vdc	50 Max.	1 second, Max., 24Vin(nom)	300 Typ.	300 Typ.	With a 4.7µF/50V X7R MLCC, 24Vout, 28Vout
	100 Max.	48Vin(nom)			
	185 Max.	110Vin(nom)			
Input filter <sup>(1)</sup>	Pi type		Temperature coefficient, %/°C	-0.02 Min., +0.02 Max.	
Remote ON/OFF, Vdc	Short or 0 Typ., 1.2 Max.	Referenced to -Vin pin, Negative logic, DC-DC ON	Transient response recovery time, µs	200 Typ., 250 Max.	25% load step chance
	Open or 3 Typ., 12 Max.	(Standard), DC-DC OFF	Over voltage protection, %	115 Min., 130 Max.	% of Vout(nom); Hiccup mode
	Open or 3 Typ., 12 Max.	Positive logic, DC-DC ON	Over load protection, %	120 Min., 150 Max.	% of lout rated; Hiccup mode
	Short or 0 Typ., 1.2 Max.	(Option), DC-DC OFF	Short circuit protection	Continuous, automatic recovery	
	-0.5 Min., 1 Max.	Input current of Ctrl pin			
	3mA Typ.	Remote off input current			
Sync pin signal <sup>(2)</sup> , Vdc	-0.3 Min., 5.6 Max.				

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

Environmental Specifications				
Operating case temperature, °C	Base-plate	-40		+115
Over temperature protection, °C			+120	
Storage temperature range, °C	Terminal block type	-40		+105
	Others	-55		+125
Thermal impedance <sup>(3)</sup> , °C/W	Vertical direction by natural convection (20LFM)			
	Module without assembly option		6.1	
	Only mount on the iron base-plate		2.8	
	Heat-sink type with 0.24" Height		5.1	
	Heat-sink type with 0.45" Height		4.6	
Thermal shock		MIL-STD-810F		
Shock		EN61373, MIL-STD-810F		
Vibration		EN61373, MIL-STD-810F		
Relative humidity		5% to 95% RH		

# HWB150 SERIES

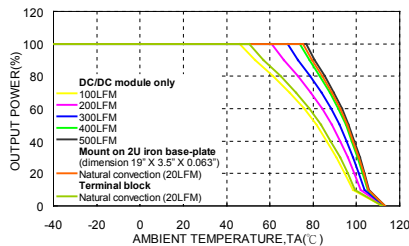
Physical Specifications	
Design meet safety standard	IEC60950-1, UL60950-1, EN60950-1, EN50155
Case material	Metal, 24Vin(nom) and 48Vin(nom) Aluminum base-plate with plastic case, 110Vin(nom)
Base material	FR4 PCB, 24Vin(nom) and 48Vin(nom)
Potting material	Silicone (UL94 V-0)
Weight	105g (3.70oz)
MTBF	3.500x10 <sup>5</sup> hrs , MIL-HDBK-217F, Full load
Dimensions	2.28" × 2.40" × 0.50"

EMC Specifications			
Specifications	Conditions		Level
EMI(4)	EN55011, EN55022		Class A
			Class B
ESD	EN61000-4-2	Air +/-8kV and Contact +/-6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3	20V/m	Perf. Criteria A
Fast transient(5)	EN61000-4-4	+/-2kV	Perf. Criteria A
Surge(5)	EN61000-4-5	EN55024 +/-2kV and EN50155 +/-2kV	Perf. Criteria A
Conducted immunity	EN61000-4-6	10Vr.m.s	Perf. Criteria A

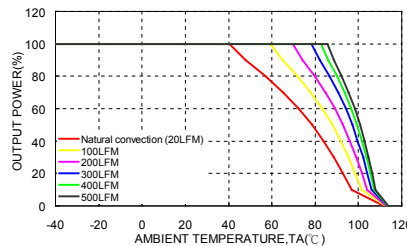
- Note:**
- Input source impedance: The power modules will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module. Since real-world voltage source has finite impedance, performance can be improved by adding external filter capacitor. The HWB150-24SXX and HWB150-48SXX recommended Nippon Chemi-con KY series, 100~F/100V. The HWB150-110SXX recommended Ruby-con BFX series, 68~F/200V.
  - (1) Multiple HWB150 series module can be synchronized together simply by connecting the module 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.
  - (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 PIN: 7G-0021A-F, 7G-0022A-F, 7G-0023A-F, 7G-0024A-F. Please refer to heat-sink selection guide.
  - The HWB150 series standard module meets EN55011, EN55022 Class A and Class B with external components.
  - An external input filter capacitor is required if the module has to meet EN61 000-4-4, EN61 000-4-5. The HWB150-24SXX and HWB150-48SXX recommended 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220~F/100V) to connect in parallel. The HWB150-110SXX recommended 3 pcs of aluminum electrolytic capacitor (Ruby-con BFX series, 100~F/250V) to connect in parallel.
  - CASE GROUNDING: Connecting four screw bolts to shield plane will help to reduce the EMI.
  - For further information, please contact Polytron Devices.

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

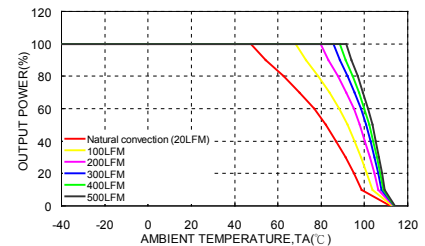
## Characteristic Curve



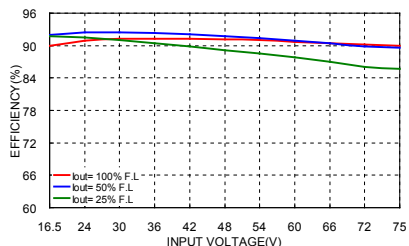
HWB150-48S05 Derating Curve (Note 3)



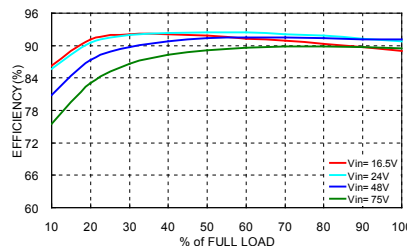
HWB150-48S05 Derating Curve (Note 3)  
With 0.24" Height Heat-sink



HWB150-48S05 Derating Curve (Note 3)  
With 0.45" Height Heat-sink



HWB150-48S05 Efficiency vs. Input Voltage

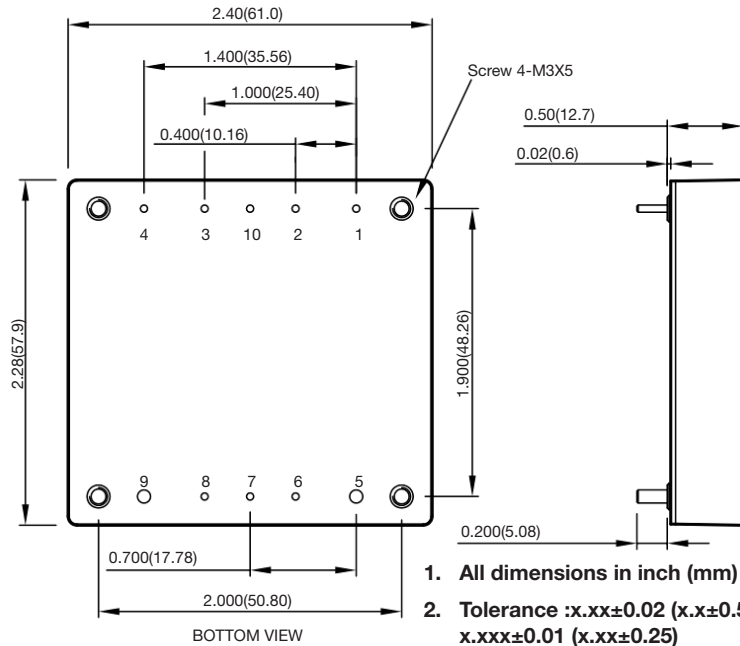


HWB150-48S05 Efficiency vs. Output Load

# HWB150 SERIES

## Mechanical Drawing

### HWB150-24SXX, HWB150-48SXX



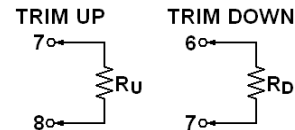
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)  
x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)
5. Mounting screws should always be used.
6. The screw locked torque:  
MAX 5.0kgf-cm/0.49N-m

### 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

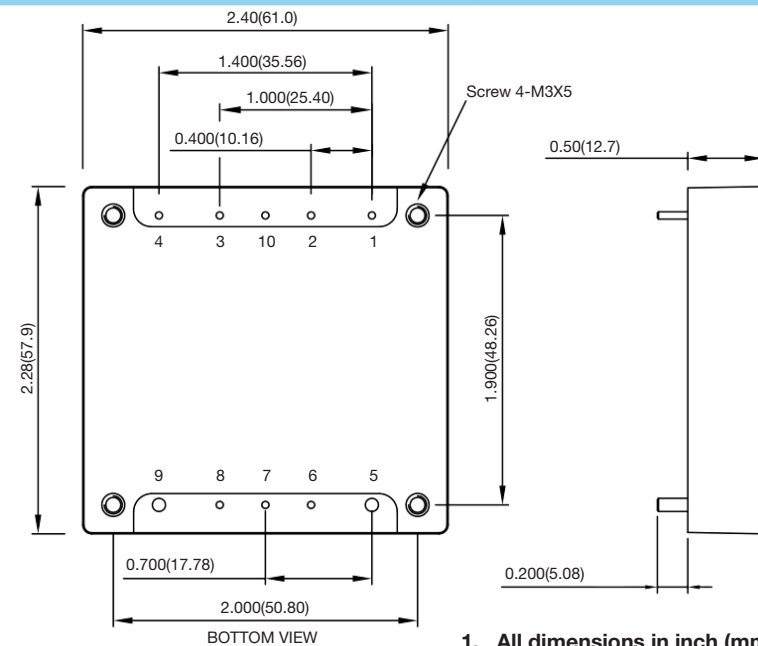
Output can be externally trimmed by using the method shown below.



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

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

### HWB150-110SXX

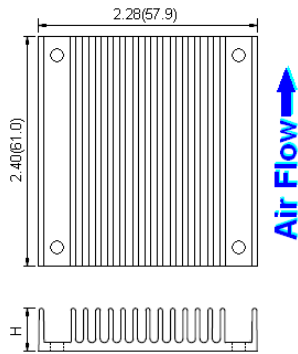


1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)
5. Mounting screws should always be used.
6. The screw locked torque: MAX 3.5kgf-cm/0.34N-m

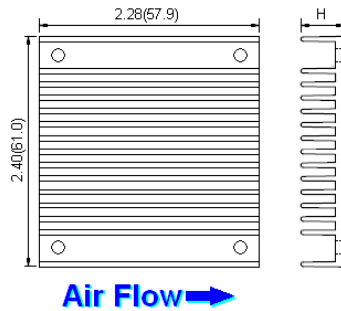
## HWB150 SERIES

### Characteristic Curve

Vertical Fin Orientation, Suffix: -HS, -HS2



Horizontal Fin Orientation, Suffix: -HS1, -HS3

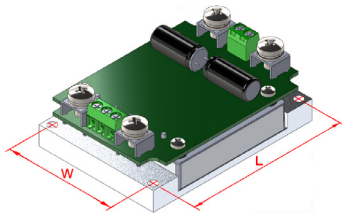


HS	Height H=0.45" vertical fin, 7G-0021A-F
HS1	Height H=0.24" horizontal fin, 7G-0022A-F
HS2	Height H=0.24" vertical fin, 7G-0023A-F
HS3	Height H=0.45" horizontal fin, 7G-0024A-F

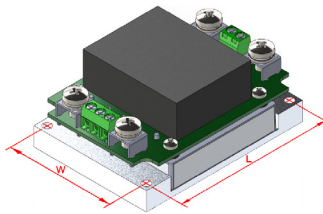
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)  
x.xxx±0.01 (x.xx±0.25)

### Terminal Block Type Option

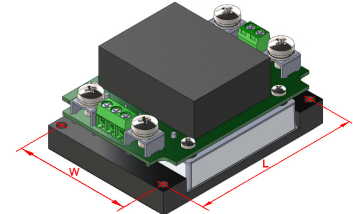
Wall mounted, Suffix: -T



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 (W×L)	2.126 x 3.071 inch (54.00 x 78.00 mm), 4-∅0.17 inch (∅4.3mm)		

For further information, please contact Polytron Devices.