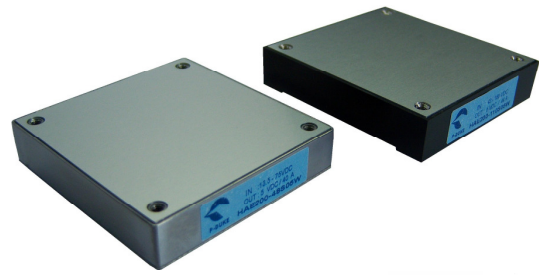


# HAE200W SERIES

HALF-BRICK DC-DC CONVERTER

4:1 ULTRA WIDE INPUT RANGE  
UP TO 240 Watts



## FEATURES

- NO MINIMUM LOAD REQUIRED
- SOFT-START
- 2250VDC INPUT TO OUTPUT BASIC INSULATION
- SAFETY MEETS UL60950-1, EN60950-1, IEC60950-1 AND EN50155
- CE MARK MEETS 2006/95/EC, 2011/95/EC AND 2004/108/EC
- COMPLIANT TO RoHS EU DIRECTIVE 2011/65/UE

## APPLICATIONS

- RAILWAY SYSTEM
- WIRELESS NETWORK
- TELECOM/DATACOM
- INDUSTRY CONTROL SYSTEM
- DISTRIBUTED POWER ARCHITECTURES
- SEMICONDUCTOR EQUIPMENT

2250VDC ISOLATION	REMOTE CONTROL	UVP	OCP	SCP	OVP	OTP	SYNC
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## TECHNICAL SPECIFICATION

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

Model Number	Input Range	Output Voltage	Output Current @Full Load	Input Current @ No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	A	mA	%	µF
HAE200-24S3P3W	9 ~ 36	3.3	50	25	87	151000
HAE200-24S05W	9 ~ 36	5	36	30	90	72000
HAE200-24S12W	8.5 ~ 36	12	15	30	89	12500
HAE200-24S15W	8.5 ~ 36	15	12	30	90	8000
HAE200-24S24W	8.5 ~ 36	24	7.5	35	90	3100
HAE200-24S28W	8.5 ~ 36	28	6.5	40	90	2300
HAE200-24S48W	8.5 ~ 36	48	3.7	45	89	770
HAE200-48S3P3W	16.5 ~ 75	3.3	50	20	88	151000
HAE200-48S05W	16.5 ~ 75	5	40	20	91	80000
HAE200-48S12W	16.5 ~ 75	12	18	20	90	15000
HAE200-48S15W	16.5 ~ 75	15	14	20	91	9300
HAE200-48S24W	16.5 ~ 75	24	9	20	90	3700
HAE200-48S28W	16.5 ~ 75	28	7.5	25	91	2600
HAE200-48S48W	16.5 ~ 75	48	4.5	25	90	930
HAE200-110S3P3W	43 ~ 160	3.3	57	10	87	172000
HAE200-110S05W	43 ~ 160	5	44	10	89	88000
HAE200-110S12W	43 ~ 160	12	20	10	89	16600
HAE200-110S15W	43 ~ 160	15	16	10	90	10600
HAE200-110S24W	43 ~ 160	24	10	10	89	4100
HAE200-110S28W	43 ~ 160	28	8.5	15	90	3000
HAE200-110S48W	43 ~ 160	48	5	15	89	1000

## PART NUMBER STRUCTURE

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range	Ctrl and Pin Options	SYNC pin Option	CASE pin Option	Through hole type <sup>(1)</sup>	Assembly Option
HAE200-48S05W-PTH HS	24:8.5~36 9~36 48:16.5~75 110:43~160	S:Single	3P3:3.3 05:5 12:12 15:15 24:24 28:28 48:48	4:1	□:Negative logic, 0.200" pin length L:Negative logic, 0.145" pin length P:Positive logic, 0.200" pin length S:Positive logic, 0.145"pin length	□:NC Y:SYNC pin	□:NC C:CASE pin	□: Thread TH: No thread	□: No Heat-sink <b>Heat-sink type:</b> 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 <b>Terminal block type<sup>(2)</sup>:</b> T: Wall mounted TF: Wall mounted with EMC filter <sup>(3)</sup> TF1: Wall mounted with EMC filter can be connected to PE Ⓢ <sup>(3)</sup>

(1) The module can't equip Heat-sink with TH option.

(2) No Y and C function for terminal block type, and terminal block type only for 0.200" pin length.

(3) EMI filter meet EN55011, EN55022 Class A.

INPUT SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating input voltage range		24Vin(nom)	9	24	36	VDC
		3.3 & 5Vout Others	8.5	24	36	
		48Vin(nom)	16.5	48	75	
		110Vin(nom)	43	110	160	
Start up voltage		24Vin(nom)			9	VDC
		48Vin(nom)			18	
		110Vin(nom)			43	
Shutdown voltage		24Vin(nom)	7.3		8.1	VDC
		48Vin(nom)	15.5		16.3	
		110Vin(nom)	33.0		36.0	
Start up time	Constant resistive load	Power up Remote ON/OFF		75 75		ms
Input surge voltage	1 second, max.	24Vin(nom) 48Vin(nom) 110Vin(nom)			50 100 185	VDC
Input filter <sup>(1)</sup>					Pi type	
Remote ON/OFF	Referenced to -INPUT pin	Negative logic (Standard) Positive logic (Option) Input current of CTRL pin Remote off input current			Short or 0 ~ 1.2VDC Open or 3 ~ 12 VDC Open or 3 ~ 12 VDC Short or 0 ~ 1.2VDC	
			-0.5		1	mA
				3		mA
SYNC pin signal <sup>(2)</sup>			-0.3		5.6	VDC

OUTPUT SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Voltage accuracy			-1.0		+1.0	%
Line regulation	Low Line to High Line at Full Load		-0.1		+0.1	%
Load regulation	No Load to Full Load		-0.1		+0.1	%
Voltage adjustability	Maximum output deviation is inclusive of remote sense		-20		+10	%
Remote sense	% of Vout(nom) If remote sense is not being used, SENSE pins should be connected to corresponding polarity OUTPUT pins.				10	%
Ripple and noise	Measured by 20MHz bandwidth					
	With a 1μF/25V X7R MLCC and a 22μF/25V POS-CAP	3.3Vout, 5Vout		75		
	With a 1μF/25V X7R MLCC and a 22μF/25V POS-CAP	12Vout, 15Vout		100		mVp-p
	With a 4.7μF/50V X7R MLCC	24Vout, 28Vout		200		
	With a 2.2μF/100V X7R MLCC	48Vout		300		
Temperature coefficient			-0.02		+0.02	%/°C
Transient response recovery time	25% load step change			200	250	μs
Over voltage protection	% of Vout(nom); Hiccup mode		115		130	%
Over load protection	% of Iout rated; Hiccup mode		120		150	%
Short circuit protection						Continuous, automatic recovery

GENERAL SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute (Basic insulation)	Input to Output	2250			VDC
		Input (Output) to Case	1600			
Isolation resistance	500VDC		1			GΩ
Isolation capacitance					2500	pF
Switching frequency			225	250	275	kHz
Design meet safety standard			IEC60950-1, UL60950-1, EN60950-1 EN50155			
Case material		24Vin(nom) and 48Vin(nom) 110Vin(nom)				Metal Aluminum base-plate with plastic case
Base material		24Vin(nom) and 48Vin(nom)				FR4 PCB
Potting material						Silicon (UL94-V0)
Dimensions						2.40×2.28×0.50 Inch (61.0×57.9×12.7 mm)
Weight						105g (3.70oz)
MTBF	BELLCORE TR-NWT-000332 Case 1: 50% Stress, Ta= 40°C . MIL-HDBK-217F Ta=25°C, Full load (G/B, controlled environment)					1.010×10 <sup>6</sup> hrs
						7.416×10 <sup>4</sup> hrs

**ENVIRONMENTAL SPECIFICATIONS**

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating case temperature	Base-plate	-40		+115	°C
Over temperature protection			+120		°C
Storage temperature range	Terminal block type	-40		+105	°C
	Others	-55		+125	°C
Thermal impedance <sup>(3)</sup>	Vertical direction by natural convection (20LFM)				
	Module w/o assembly option		6.1		°C/W
	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			EN61373, MIL-STD-810F		
Vibration			EN61373, MIL-STD-810F		
Relative humidity				5% to 95% RH	

**EMC SPECIFICATIONS**

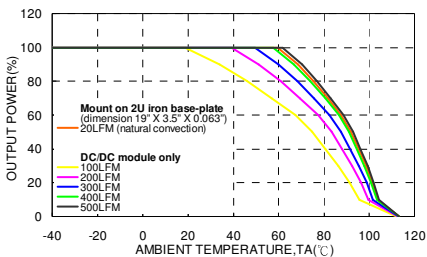
Parameter	Conditions	Level
EMI <sup>(4)</sup>	EN55011, EN55022	Standard
		Option TF or TF1
ESD	Air ± 8kV and Contact ± 6kV	Class A Class B Class A
Radiated immunity	20V/m	Perf. Criteria A
Fast transient <sup>(5)</sup>	± 2kV	Perf. Criteria A
Surge <sup>(5)</sup>	EN55024 ±2kV and EN50155 ±2kV	Perf. Criteria A
Conducted immunity	10Vr.m.s	Perf. Criteria A

**Note:**

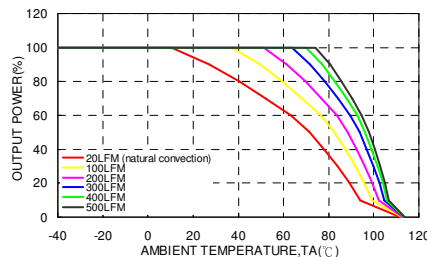
- Input source impedance: The power modules will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module. Since real-world voltage source has finite impedance, performance can be improved by adding external filter capacitor. The HAE200-24S□□W and HAE200-48S□□W recommended Nippon Chemi-con KY series, 100μF/100V. The HAE200-110S□□W recommended Ruby-con BXF series, 68μF/200V.
- (1) Multiple HAE200W 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 P/N: 7G-0021A-F, 7G-0022A-F, 7G-0023A-F, 7G-0024A-F. Please refer to heat-sink selection guide.
- The HAE200W series standard module meets EN55011, EN55022 Class A and Class B with external components. For more detail information, please contact with P-DUKE.
- An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. The HAE200-24S□□W and HAE200-48S□□W recommended 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220μF/100V) to connect in parallel. The HAE200-110S□□W recommended 3 pcs of aluminum electrolytic capacitor (Ruby-con BXF series, 100μF/250V) to connect in parallel.
- CASE GROUNDING : When connect four screw bolts to shield plane, the EMI could be reduced.

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

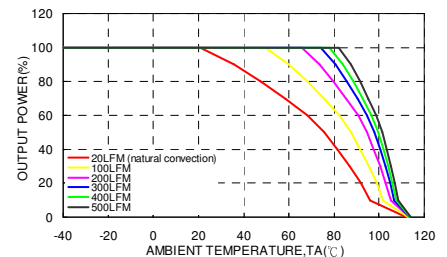
**CHARACTERISTIC CURVE**



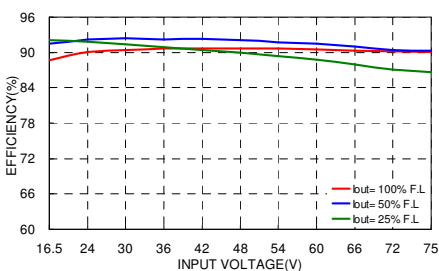
HAE200-48S05W Derating Curve (Note 3)



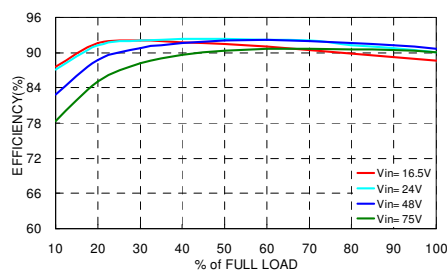
HAE200-48S05W Derating Curve (Note 3) With 0.24" Height Heat-sink



HAE200-48S05W Derating Curve (Note 3) With 0.45" Height Heat-sink



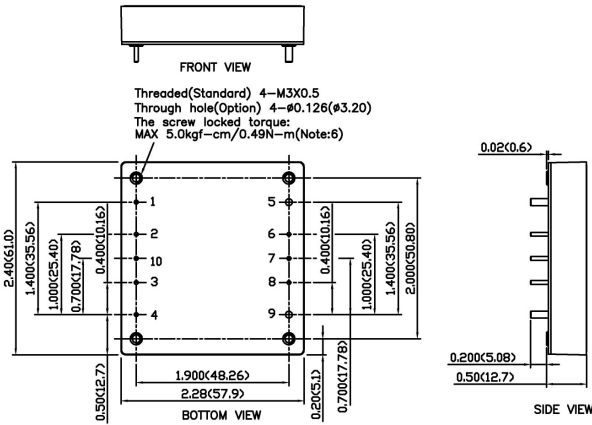
HAE200-48S05W Efficiency VS Input Voltage



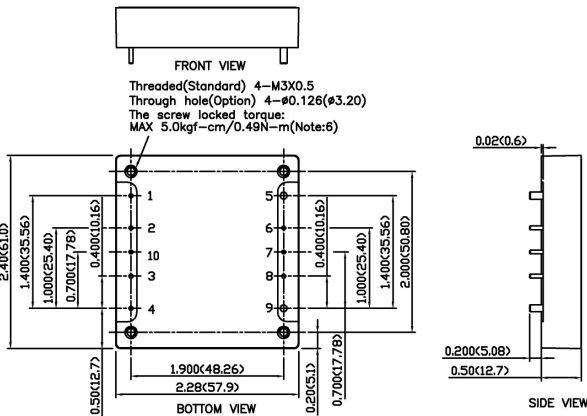
HAE200-48S05W Efficiency VS Output Load

**MECHANICAL DRAWING**

**Metal case mechanical drawing:**



**Plastic case mechanical drawing:**

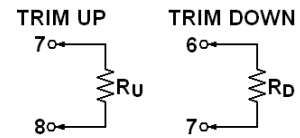


**PIN CONNECTION**

PIN	DEFINE	DIAMETER
1	- INPUT	0.04 Inch
2	CASE (option)	0.04 Inch
3	CTRL	0.04 Inch
4	+ INPUT	0.04 Inch
5	- OUTPUT	0.08 Inch
6	- SENSE	0.04 Inch
7	TRIM	0.04 Inch
8	+ SENSE	0.04 Inch
9	+ OUTPUT	0.08 Inch
10	SYNC (option)	0.04 Inch

**EXTERNAL OUTPUT TRIMMING**

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



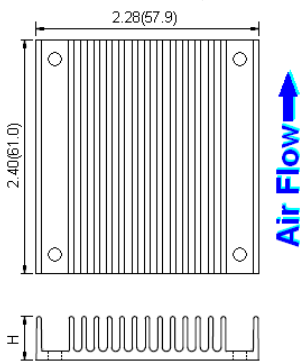
$$R_U = \left( \frac{V_{OUT} (100 + \Delta\%)}{1.225 \Delta\%} - \frac{(100 + 2\Delta\%)}{\Delta\%} \right) k\Omega$$

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

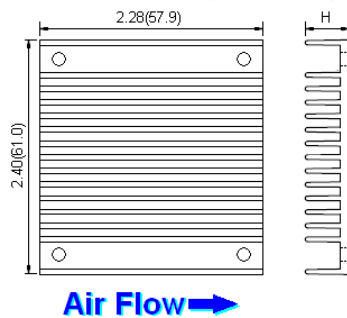
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)  
x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)

**HEAT-SINK TYPE OPTIONS**

Vertical Fin Orientation, Suffix:-HS, -HS2



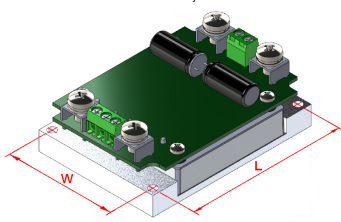
Horizontal Fin Orientation, Suffix:-HS1, -HS3



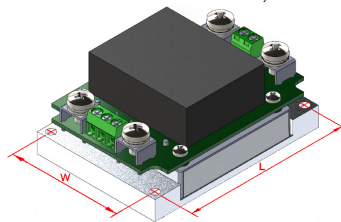
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)  
x.xxx±0.01 (x.xx±0.25)

**TERMINAL BLOCK TYPE OPTION**

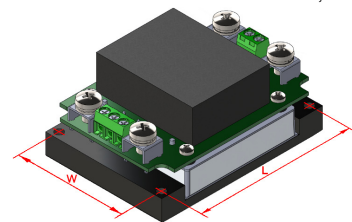
Wall mounted, Suffix: -T



Wall mounted with EMC Filter, Suffix: -TF



Wall mounted with EMC Filter, Suffix: -TF1



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-φ 0.17 inch (φ 4.3mm)		

For more detail information, please contact with P-DUKE.