POWER MATE TECHNOLOGY CO., LTD.

HAE200 SERIES

HALF-BRICK DC-DC CONVERTER

2:1 WIDE INPUT RANGE
UP TO 255 Watts

RoHS Compliant

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/EU

APPLICATIONS

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

2250VDC ISOLATION	REMOTE CONTROL	UVP	OCP	SCP	OVP	OTP	SYNC

TECHNICAL SPECIFICATION

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

Model Number	Input Range VDC	Output Voltage VDC	Output Current @Full Load A	Input Current @ No Load mA	Efficiency %	Maximum Capacitor Load µF
HAE200-12S3P3	9 ~ 22	3.3	50	25	87	151000
HAE200-12S05	9 ~ 22	5	36	90	90	72000
HAE200-12S12	8.5 ~ 22	12	15	90	90	12500
HAE200-12S15	8.5 ~ 22	15	12	55	90	8000
HAE200-12S24	8.5 ~ 22	24	7.5	70	90	3100
HAE200-12S28	8.5 ~ 22	28	6.5	55	90	2300
HAE200-12S48	8.5 ~ 22	48	3.7	75	89	770
HAE200-24S3P3	16.5 ~ 36	3.3	50	20	88	151000
HAE200-24S05	16.5 ~ 36	5	40	35	91	80000
HAE200-24S12	16.5 ~ 36	12	18	45	91	15000
HAE200-24S15	16.5 ~ 36	15	15	45	91	10000
HAE200-24S24	16.5 ~ 36	24	9	40	93	3700
HAE200-24S28	16.5 ~ 36	28	7.5	50	93	2600
HAE200-24S48	16.5 ~ 36	48	4.5	50	91	930
HAE200-48S3P3	33 ~ 75	3.3	60	20	90	181000
HAE200-48S05	33 ~ 75	5	46	20	91	92000
HAE200-48S12	33 ~ 75	12	21	25	91	17500
HAE200-48S15	33 ~ 75	15	17	25	93	11300
HAE200-48S24	33 ~ 75	24	10.5	25	92	4300
HAE200-48S28	33 ~ 75	28	9	25	92	3200
HAE200-48S48	33 ~ 75	48	5.2	25	92	1000
HAE200-48S53	33 ~ 75	53	4.7	25	92	880

PART NUMBER STRUCTURE

HAE200 - 48 S 05 - P Y C TH HS

Series Name

Input Voltage (VDC)
12:9~22
8.5~22
24:16.5~36
48:33~75

Output Quantity
S:Single

Output Voltage (VDC)
3P3:3.3
05:5
12:12
15:15
24:24
28:28
48:48
53:53

Ctrl and Pin Options
□: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

SYNC pin Option
□:NC
Y:SYNC pin

CASE pin Option
□:NC
C:CASE pin

Through hole type(1)
□: Thread
TH: No thread

Assembly Option
□: No Heat-sink
Heat-sink type:
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
Terminal block type(2)**:**
T: Wall mounted
TF: Wall mounted with EMC filter(3)
TF1: Wall mounted with EMC filter can be connected to PE ⏚(3)

(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 EN55022 Class A.

INPUT SPECIFICATIONS

Parameter	Conditions			Min.	Typ.	Max.	Unit
Operating input voltage range		12Vin(nom)	3.3 & 5Vout	9	12	22	VDC
			Others	8.5	12	22	
		24Vin(nom)		16.5	24	36	
		48Vin(nom)		33	48	75	
Start up voltage		12Vin(nom)				9	VDC
		24Vin(nom)				18	
		48Vin(nom)				34	
Shutdown voltage		12Vin(nom)		7.3		8.1	VDC
		24Vin(nom)		15.5		16.3	
		48Vin(nom)		31.6		32.5	
Start up time	Constant resistive load	Power up			75		ms
		Remote ON/OFF			75		
Input surge voltage	1 second, max.	12Vin(nom)				30	
		24Vin(nom)				50	
		48Vin(nom)				100	
Input filter (1)					Pi type		
Remote ON/OFF	Referenced to –INPUT pin	Negative logic	DC-DC ON		Short or 0 ~ 1.2VDC		
		(Standard)	DC-DC OFF		Open or 3 ~ 12 VDC		
		Positive logic	DC-DC ON		Open or 3 ~ 12 VDC		
		(Option)	DC-DC OFF		Short or 0 ~ 1.2VDC		
		Input current of CTRL pin		-0.5		1	mA
		Remote off input current			3		mA
SYNC pin signal (2)				-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		mVp-p
	With a 1μF/25V X7R MLCC and a 22μF/25V POS-CAP	12Vout, 15Vout		100		
	With a 4.7μF/50V X7R MLCC	24Vout, 28Vout		200		
	With a 2.2μF/100V X7R MLCC	48Vout, 53Vout		300		
Temperature coefficient			-0.02		+0.02	%/℃
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, automatics 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			
Case material						Metal
Base material						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℃.					1.010×10^6 hrs
	MIL-HDBK-217F Ta=25℃, Full load (G/B, controlled environment)					7.416×10^4 hrs

ENVIRONMENTAL SPECIFICATIONS

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating case temperature		-40		+115	℃
Over temperature protection			+120		℃
Storage temperature range	Terminal block type Others	-40 -55		+105 +125	℃
Thermal impedance (3)	Vertical direction by natural convection (20LFM) Module w/o assembly option Only mount on the iron base-plate Heat-sink type with 0.24" Height Heat-sink type with 0.45" Height		 6.1 2.8 5.1 4.6		 ℃/W
Thermal shock					MIL-STD-810F
Vibration					MIL-STD-810F
Relative humidity					5% to 95% RH

EMC SPECIFICATIONS

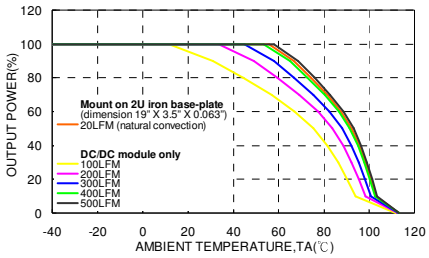
Parameter	Conditions		Level
EMI (4)	EN55022	Standard Option TF or TF1	Class A Class B Class A
ESD	EN61000-4-2	Air ±8kV and Contact ±6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3	20V/m	Perf. Criteria A
Fast transient (5)	EN61000-4-4	±2kV	Perf. Criteria A
Surge (5)	EN61000-4-5	EN55024 ±2kV	Perf. Criteria A
Conducted immunity	EN61000-4-6	10Vr.m.s	Perf. Criteria A

Note:

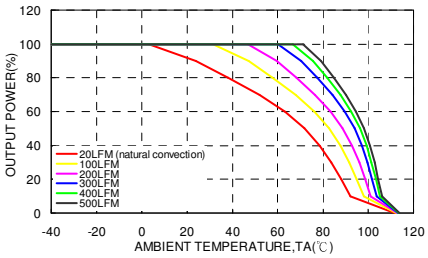
1. Input source impedance: The power modules will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module. Since real-world 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 HAE200 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.
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 HAE200 series standard module meets EN55022 Class A and Class B with external components. For more detail information, please contact with P-DUKE.
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：When connect four screw bolts to shield plane, the EMI could be reduced.

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

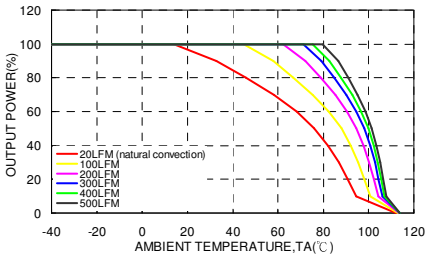
CHARACTERISTIC CURVE



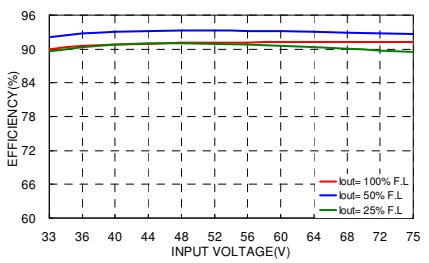
HAE200-48S05 Derating Curve (Note 3)



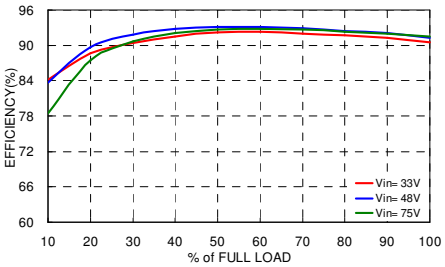
HAE200-48S05 Derating Curve (Note 3)
With 0.24" Height Heat-sink



HAE200-48S05 Derating Curve (Note 3)
With 0.45" Height Heat-sink



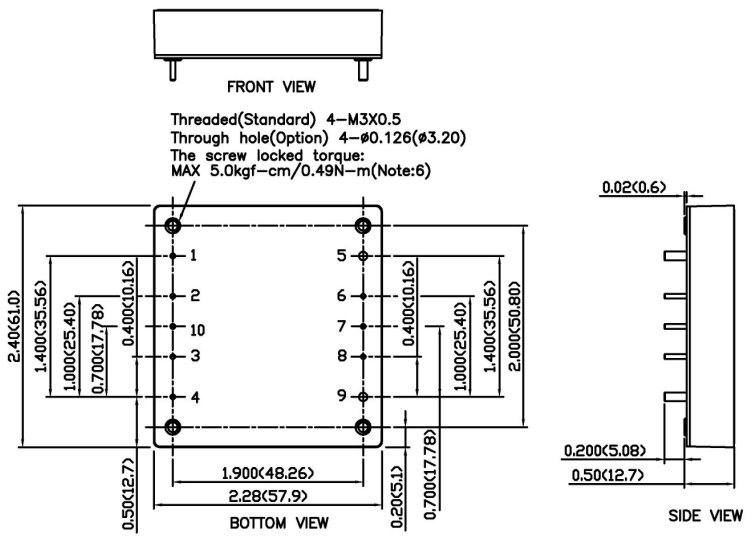
HAE200-48S05 Efficiency VS Input Voltage



HAE200-48S05 Efficiency VS Output Load

MECHANICAL DRAWING

Metal case mechanical drawing:

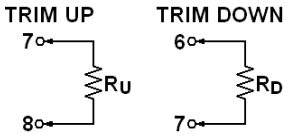


PIN CONNECTION

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.



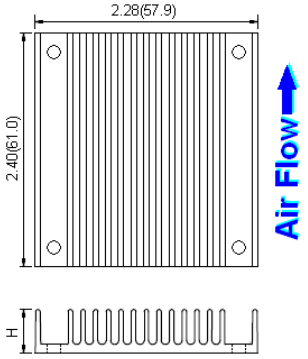
$$R_U = \left(\frac{V_{OUT}\ (100\ + \Delta\%)}{1.225\ \Delta\%} - \frac{(100\ + 2\Delta\%)}{\Delta\%} \right) k\Omega$$

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

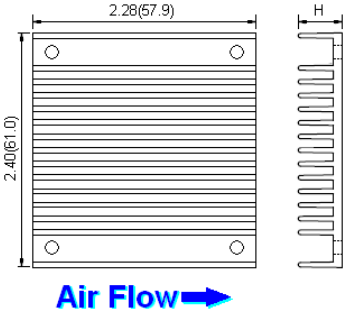
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)
   x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)

HEAT-SINK TYPE OPTIONS

Vertical Fin Orientation, Suffix:-HS, -HS2



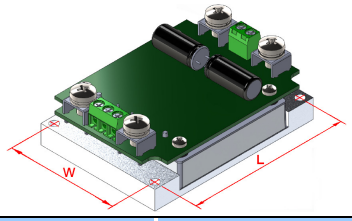
Horizontal Fin Orientation, Suffix:-HS1, -HS3



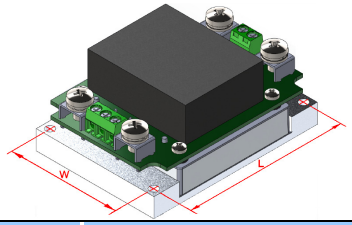
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)
   x.xxx±0.01 (x.xx±0.25)

TERMINAL BLOCK TYPE OPTION

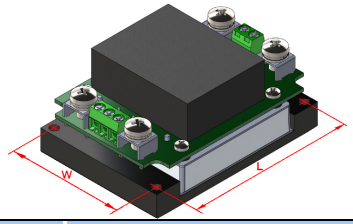
Wall mounted, Suffix: -T



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.