

HAE100W SERIES

HALF-BRICK DC-DC CONVERTER

4:1 ULTRA WIDE INPUT RANGE
UP TO 100Watts



FEATURES

- NO MINIMUM LOAD REQUIRED
- 3000VAC REINFORCED INSULATION FOR 110VIN
2250VDC BASIC INSULATION FOR 24VIN AND 48VIN
- UL60950-1, EN60950-1, IEC60950-1, & EN50155 SAFETY APPROVALS
- CE MARKED
- COMPLIANT TO RoHS II & REACH

APPLICATIONS

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

3000VAC ISOLATION	2250VDC ISOLATION	REMOTE CONTROL	UVP	OC	SCP	OVP	OTP
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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
HAE100-24S3P3W	9 ~ 36	3.3	25	20	91	75700
HAE100-24S05W	9 ~ 36	5	20	25	93	40000
HAE100-24S12W	8.5 ~ 36	12	8.4	25	90	7000
HAE100-24S15W	8.5 ~ 36	15	6.7	25	91	4460
HAE100-24S24W	8.5 ~ 36	24	4.2	25	90	1750
HAE100-24S28W	8.5 ~ 36	28	3.6	25	90	1280
HAE100-24S48W	8.5 ~ 36	48	2.1	35	90	430
HAE100-48S3P3W	16.5 ~ 75	3.3	25	15	91	75700
HAE100-48S05W	16.5 ~ 75	5	20	15	93	40000
HAE100-48S12W	16.5 ~ 75	12	8.4	20	90	7000
HAE100-48S15W	16.5 ~ 75	15	6.7	20	91	4460
HAE100-48S24W	16.5 ~ 75	24	4.2	20	90	1750
HAE100-48S28W	16.5 ~ 75	28	3.6	20	92	1280
HAE100-48S48W	16.5 ~ 75	48	2.1	25	91	430
HAE100-110S3P3W	43 ~ 160	3.3	25	10	87	75700
HAE100-110S05W	43 ~ 160	5	20	10	90	40000
HAE100-110S12W	43 ~ 160	12	8.4	10	90	7000
HAE100-110S15W	43 ~ 160	15	6.7	10	90	4460
HAE100-110S24W	43 ~ 160	24	4.2	10	90	1750
HAE100-110S28W	43 ~ 160	28	3.6	10	90	1280
HAE100-110S48W	43 ~ 160	48	2.1	10	91	430

PART NUMBER STRUCTURE

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range	Ctrl and Pin Option	Through Hole Type ⁽¹⁾	Assembly Option
HAE100 - 48 S 05 W - P TH 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	□: Thread TH: No thread	□: 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) 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) 3.3 & 5Vout	9	24	36	VDC
		Others	8.5	24	36	
		48Vin(nom)	16.5	48	75	
Start up voltage		110Vin(nom)	43	110	160	VDC
		24Vin(nom)			9	
		48Vin(nom)			18	
Shutdown voltage		110Vin(nom)			43	VDC
		24Vin(nom)	7.3		8.1	
		48Vin(nom)	15.5		16.3	
Start up time	Constant resistive load	110Vin(nom)	33.0		36.0	ms
		Power up		75		
Input surge voltage	1 second, max.	Remote ON/OFF		75		ms
		24Vin(nom)			50	
Input filter ⁽¹⁾		48Vin(nom)			100	VDC
		110Vin(nom)			185	
		Pi type				
Remote ON/OFF	Referred to -Vin pin	Negative logic (Standard)	DC-DC ON	Short or 0 ~ 1.2VDC		mA
		Positive logic (Option)	DC-DC OFF	Open or 3 ~ 12 VDC		
			DC-DC ON	Open or 3 ~ 12 VDC		
			DC-DC OFF	Short or 0 ~ 1.2VDC		
		Input current of Ctrl pin	-0.5		1	
		Remote off input current		3		mA

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					mVp-p
	With a 1μF/25V X7R MLCC & a 22μF/25V POS-CAP	3.3Vout, 5Vout		75		
	With a 1μF/25V X7R MLCC & 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		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	24Vin(nom) and 48Vin(nom)	120		150	%
		110Vin(nom)		150		
Short circuit protection			Continuous, automatic recovery			

GENERAL SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute (Reinforced insulation)	110Vin(nom)	3000			VAC
		Input to Output	1500			
	1 minute (Basic insulation)	Others	2250			VDC
		Input (Output) to Case	1600			
Isolation resistance	500VDC		1			GΩ
Isolation capacitance					2500	pF
Switching frequency		24Vin(nom) and 48Vin(nom)	225	250	275	kHz
		110Vin(nom)	270	300	330	
Safety approvals	HAE100-24S□□W HAE100-48S□□W HAE100-110S□□W (Pending)					UL60950-1 EN60950-1 IEC60950-1 EN50155
Case material	24Vin(nom) and 48Vin(nom)					Metal
Base material	110Vin(nom)		Aluminum base-plate with plastic case			
Potting material	24Vin(nom) and 48Vin(nom)					FR4 PCB
Weight						Silicone (UL94 V-0)
MTBF	MIL-HDBK-217F, Full load					105g (3.70oz)
						4.087×10 ⁵ hrs

ENVIRONMENTAL SPECIFICATIONS

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating case temperature	Base-plate	-40		+105	°C
Over temperature protection			+115		°C
Storage temperature range	Terminal block type Others	-40 -55		+105 +125	°C
Thermal impedance ⁽²⁾	Vertical direction by natural convection (20LFM) Module without assembly option Heat-sink type with 0.24" Height Heat-sink type with 0.45" Height		6.7 5.4 4.7		°C/W
Thermal shock					MIL-STD-810F
Shock					EN61373, MIL-STD-810F
Vibration					EN61373, MIL-STD-810F
Relative humidity					5% to 95% RH

EMC SPECIFICATIONS

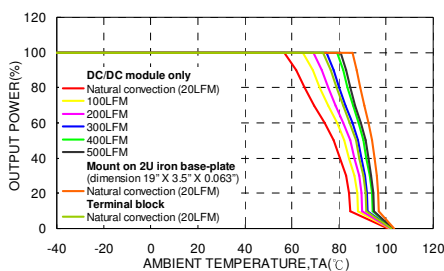
Parameter	Conditions	Level
EMI ⁽³⁾	EN55011, EN55022	Class A Class B
ESD	EN61000-4-2 Air ±8kV and Contact ±6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3 20V/m	Perf. Criteria A
Fast transient ⁽⁴⁾	EN61000-4-4 ±2kV	Perf. Criteria A
Surge ⁽⁴⁾	EN61000-4-5 EN55024 ±2kV and EN50155 ±2kV	Perf. Criteria A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

Note:

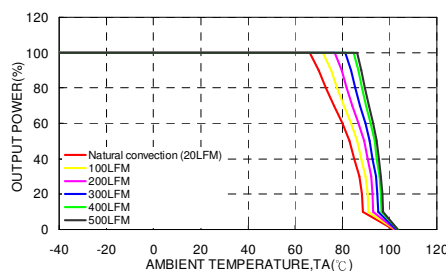
- Input source impedance: The power modules will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module. Since real-world voltage source has finite impedance, performance can be improved by adding external filter capacitor. The HAE100-24S□□W and HAE100-48S□□W recommended Nippon Chemi-con KY series, 100µF/100V. The HAE100-110S□□W recommended Ruby-con BXF series, 68µF/200V.
- (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 standard modules meet EN55011, EN55022 Class A or Class B with external components.
- An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. The HAE100-24S□□W and HAE100-48S□□W recommended 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220µF/100V) to connect in parallel. The HAE100-110S□□W recommended 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KXJ series, 150µF/200V) to connect in parallel.
- CASE GROUNDING : Connecting four screw bolts to shield plane will help to reduce the EMI.
- For further information, please contact with P-DUKE.

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

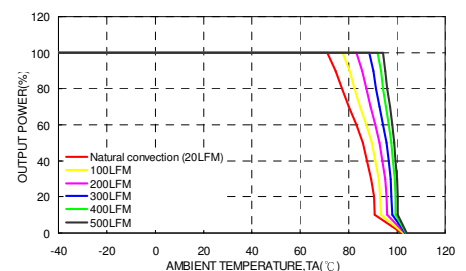
CHARACTERISTIC CURVE



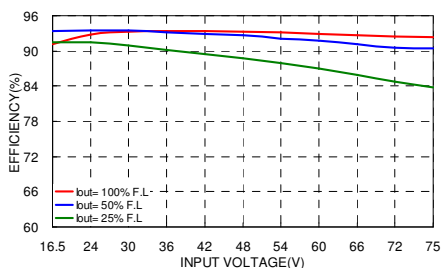
HAE100-48S05W Derating Curve (Note 2)



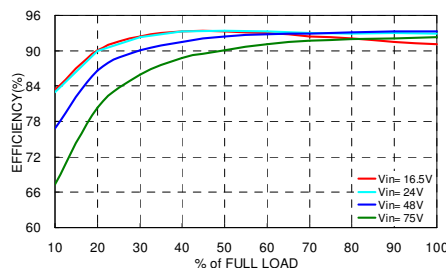
HAE100-48S05W Derating Curve (Note 2)
With 0.24" Height Heat-sink



HAE100-48S05W Derating Curve (Note 2)
With 0.45" Height Heat-sink



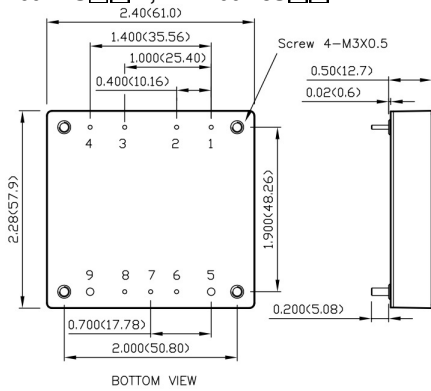
HAE100-48S05W Efficiency vs. Input Voltage



HAE100-48S05W Efficiency vs. Output Load

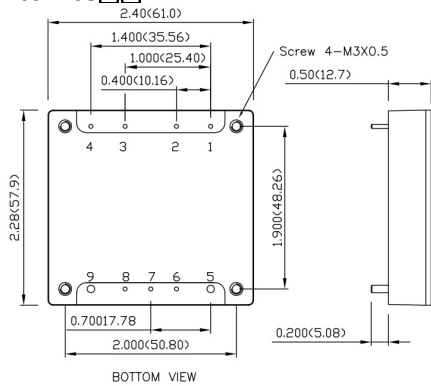
MECHANICAL DRAWING

HAE100-24S□□W, HAE100-48S□□W



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)

HAE100-110S□□W



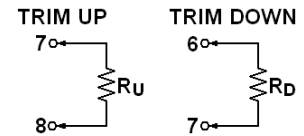
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)
x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)
5. Mounting screws should always be used.
6. The screw locked torque:
MAX 3.5kgf-cm(0.34N-m)

PIN CONNECTION

PIN	DEFINE	DIAMETER
1	-Vin	0.04 Inch
2	Case	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

EXTERNAL OUTPUT TRIMMING

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

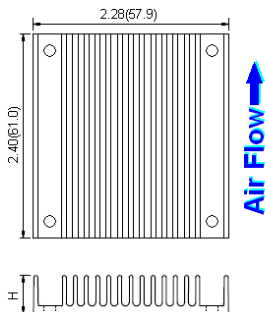


$$R_U = \left(\frac{V_{OUT} (100 + \Delta\%)}{1.225 \Delta\%} - \frac{(100 + 2\Delta\%)}{\Delta\%} \right) k\Omega$$

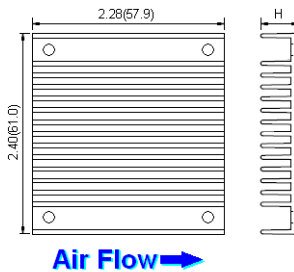
$$R_D = \left(\frac{100}{\Delta\%} - 2 \right) k\Omega$$

HEAT-SINK TYPE OPTION

Vertical Fin Orientation, Suffix:-HS, -HS2



Horizontal Fin Orientation, Suffix:-HS1, -HS3

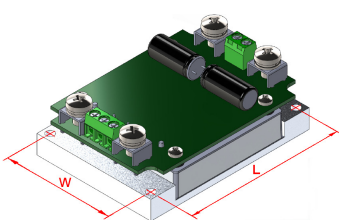


HS:	Height H=0.45" vertical fin, 7G-0021A-F
HS1:	Height H=0.24" horizontal fin, 7G-0022A-F
HS2:	Height H=0.24" vertical fin, 7G-0023A-F
HS3:	Height H=0.45" horizontal fin, 7G-0024A-F

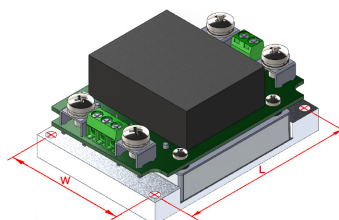
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)
x.xxx±0.01 (x.xx±0.25)

TERMINAL BLOCK TYPE OPTION

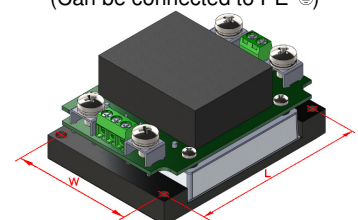
Wall mounted, Suffix: -T



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-φ 0.17 inch (φ 4.3mm)		

For further information, please contact with P-DUKE.