

# HAE100 SERIES

HALF-BRICK DC-DC CONVERTER

2:1 WIDE INPUT RANGE  
UP TO 100 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/EU

## APPLICATIONS

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

2250VDC ISOLATION	REMOTE CONTROL	UVP	OCP	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
HAE100-12S3P3	9 ~ 18	3.3	25	155	90	75700
HAE100-12S05	9 ~ 18	5	20	150	91	40000
HAE100-12S12	9 ~ 18	12	8.4	180	91	7000
HAE100-12S15	9 ~ 18	15	6.7	180	91	4460
HAE100-12S24	9 ~ 18	24	4.2	90	90	1750
HAE100-12S28	9 ~ 18	28	3.6	100	90	1280
HAE100-12S48	9 ~ 18	48	2.1	100	90	430
HAE100-24S3P3	18 ~ 36	3.3	25	90	91	75700
HAE100-24S05	18 ~ 36	5	20	150	93	40000
HAE100-24S12	18 ~ 36	12	8.4	185	93	7000
HAE100-24S15	18 ~ 36	15	6.7	185	93	4460
HAE100-24S24	18 ~ 36	24	4.2	85	92	1750
HAE100-24S28	18 ~ 36	28	3.6	85	92	1280
HAE100-24S48	18 ~ 36	48	2.1	85	92	430
HAE100-48S3P3	36 ~ 75	3.3	25	80	91	75700
HAE100-48S05	36 ~ 75	5	20	90	93	40000
HAE100-48S12	36 ~ 75	12	8.4	90	93	7000
HAE100-48S15	36 ~ 75	15	6.7	90	93	4460
HAE100-48S24	36 ~ 75	24	4.2	40	92	1750
HAE100-48S28	36 ~ 75	28	3.6	40	92	1280
HAE100-48S48	36 ~ 75	48	2.1	40	92	430

## PART NUMBER STRUCTURE

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Ctrl and Pin Options	Through hole type <sup>(1)</sup>	Assembly Option
HAE100-48S05-P-TH-HS	12:9~18 24:18~36 48:36~75	S:Single	3P3:3.3 05:5 12:12 15:15 24:24 28:28 48:48	□: 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 <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) 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)	9	12	18	VDC
		24Vin(nom)	18	24	36	
		48Vin(nom)	36	48	75	
Start up voltage		12Vin(nom)			9	VDC
		24Vin(nom)			18	
		48Vin(nom)			36	
Shutdown voltage		12Vin(nom)		7.5		VDC
		24Vin(nom)		16		
		48Vin(nom)		34		
Start up time	Constant resistive load	Power up		25		ms
		Remote ON/OFF		25		
Input surge voltage	100m second, max.	12Vin(nom)			36	VDC
		24Vin(nom)			50	
		48Vin(nom)			100	
Input filter				Pi type		
Remote ON/OFF	Referenced to -INPUT pin	Negative logic	DC-DC ON	Short or 0 ~ 1.2VDC		mA
		(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		
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)				10	%
	If remote sense is not being used, SENSE pins should be connected to corresponding polarity OUTPUT pins.					
Ripple and noise	Measured by 20MHz bandwidth					mVp-p
	With a 4.7μF/50V X7R MLCC	3.3Vout, 5Vout		75		
	With a 4.7μF/50V X7R MLCC	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		110		140	%
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			270	300	330	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			97g (3.42oz)			
MTBF	BELLCORE TR-NWT-000332 Case 1: 50% Stress, Ta= 40°C.		1.010×10 <sup>6</sup> hrs			
	MIL-HDBK-217F Ta=25°C, Full load (G/B, controlled environment)		7.416×10 <sup>4</sup> hrs			

**ENVIRONMENTAL SPECIFICATIONS**

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating case temperature		-40		+105	°C
Over temperature protection			+115		°C
Storage temperature range	Terminal block type	-40		+105	°C
	Others	-55		+125	°C
Thermal impedance <sup>(1)</sup>	Vertical direction by natural convection (20LFM)				
	Module w/o assembly option		6.7		°C/W
	Heat-sink type with 0.24" Height		5.4		
	Heat-sink type with 0.45" Height		4.7		
Thermal shock					MIL-STD-810F
Vibration					MIL-STD-810F
Relative humidity					5% to 95% RH

**EMC SPECIFICATIONS**

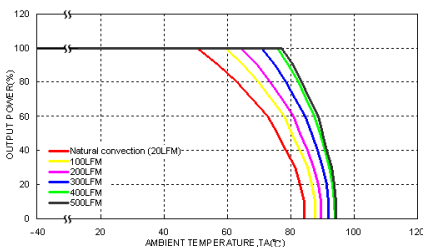
Parameter	Conditions	Level
EMI <sup>(2)</sup>	EN55022	Standard
		Option TF or TF1
ESD	EN61000-4-2 Air ±8kV and Contact ±6kV	Class A Class B Class A
Radiated immunity	EN61000-4-3 10V/m	Perf. Criteria A
Fast transient <sup>(3)</sup>	EN61000-4-4 ±2kV	Perf. Criteria A
Surge <sup>(3)</sup>	EN61000-4-5 EN55024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

**Note:**

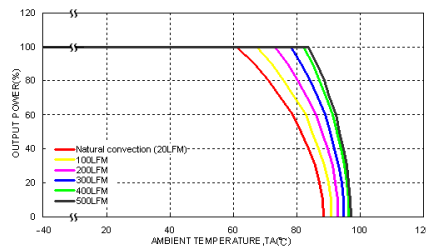
- (1) Thermal test condition with vertical direction by natural convection (20LFM).
- (2) The heat-sink is optional and P/N: 7G-0021A-F, 7G-0022A-F, 7G-0023A-F, 7G-0024A-F. Please refer to heat-sink selection guide.
- The HAE100 series standard module meets EN55022 Class A and Class B with external components. 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. Recommended 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220µF/100V) 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.

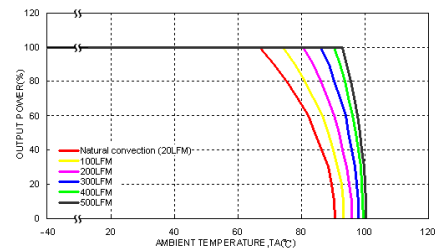
**CHARACTERISTIC CURVE**



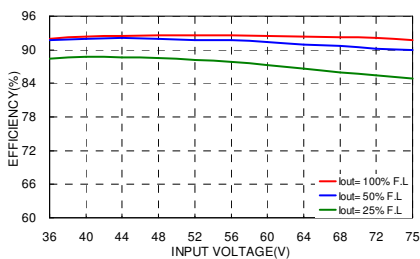
HAE100-48S05 Derating Curve (Note 1)



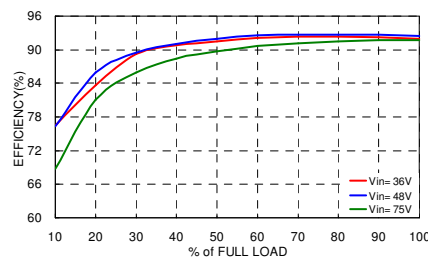
HAE100-48S05 Derating Curve (Note 1)  
With 0.24" Height Heat-sink



HAE100-48S05 Derating Curve (Note 1)  
With 0.45" Height Heat-sink



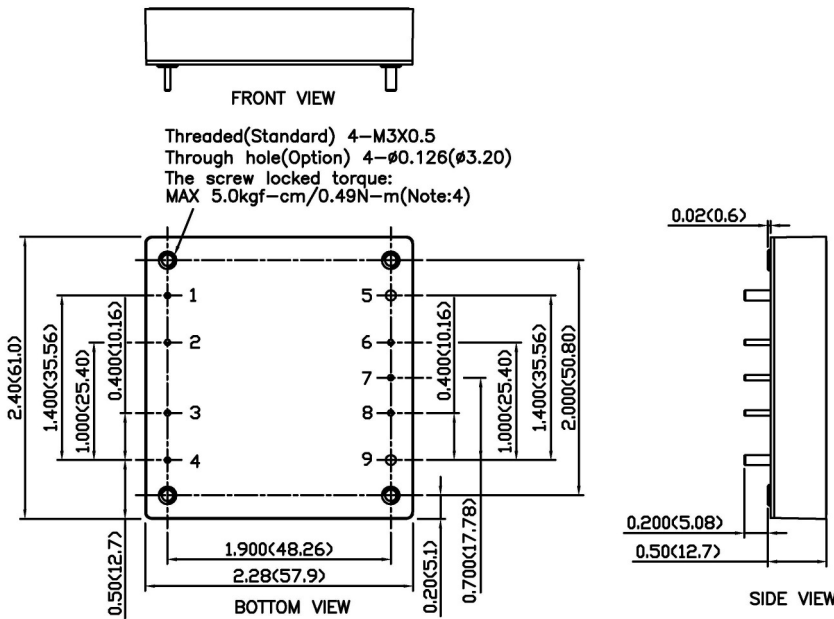
HAE100-48S05 Efficiency VS Input Voltage



HAE100-48S05 Efficiency VS Output Load

**MECHANICAL DRAWING**

Metal case mechanical drawing:

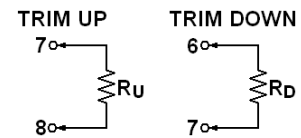


**PIN CONNECTION**

PIN	DEFINE	DIAMETER
1	- INPUT	0.04 Inch
2	CASE	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

**EXTERNAL OUTPUT TRIMMING**

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



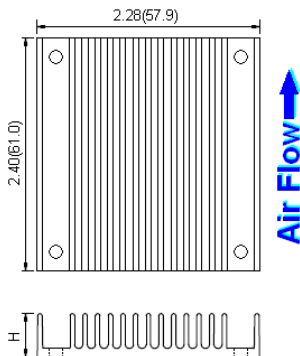
$$R_U = \left( \frac{V_{OUT} (100 + \Delta\%)}{1.225 \Delta\%} - \frac{(100 + 2\Delta\%)}{\Delta\%} \right) k\Omega$$

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

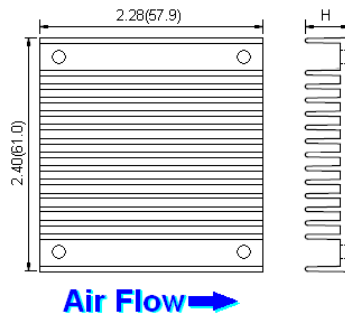
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)  
x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)

**HEAT-SINK TYPE OPTIONS**

Vertical Fin Orientation, Suffix:-HS, -HS2



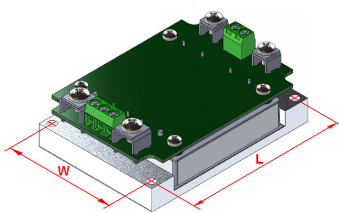
Horizontal Fin Orientation, Suffix:-HS1, -HS3



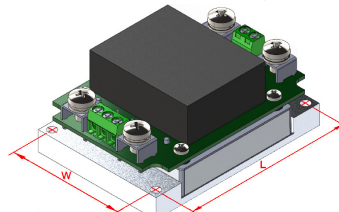
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)  
x.xxx±0.01 (x.xx±0.25)

**TERMINAL BLOCK TYPE OPTION**

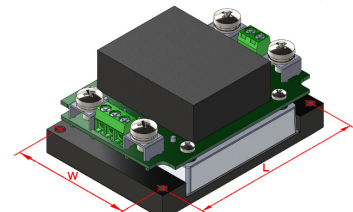
Wall mounted, Suffix: -T



Wall mounted with EMC Filter, Suffix: -TF



Wall mounted with EMC Filter, Suffix: -TF1



Terminal block type	-T	-TF	-TF1
Weight	200g (7.05oz)	280g (9.88oz)	287g (10.12oz)
Dimensions	3.35 x 2.40 x 1.10 inch (85.0 x 61.0 x 28.0mm)	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 more detail information, please contact with P-DUKE.