

# HAE150W SERIES

DC/DC Power Modules: 150 watts



PCB Model

Terminal Block Model

## Features

- NO MINIMUM LOAD REQUIRED
- 3000VAC REINFORCED INSULATION FOR 110VIN  
2250VDC BASIC INSULATION FOR 24VIN AND 48VIN
- UL60950-1, EN60950-1, & IEC60950-1 SAFETY APPROVALS
- COMPLIANCE TO EN50155 AND EN45545-2 RAILWAY STANDARD
- CE MARKED
- COMPLIANT TO RoHS II & REACH

## Applications

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

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

Model Number	Input Range VDC	Output Voltage VDC	Output Current @Full Load A	Input Current @ No Load mA	Efficiency %	Maximum Cap. Load uF
HAE150-24S3P3WP	9 ~ 36	3.3	40	20	88	121000
HAE150-24S05WP	9 ~ 36	5	28	25	90	56000
HAE150-24S12WP	8.5 ~ 36	12	12	25	90	10000
HAE150-24S15WP	8.5 ~ 36	15	9.5	25	91	6300
HAE150-24S24WP	8.5 ~ 36	24	6	25	90	2500
HAE150-24S28WP	8.5 ~ 36	28	5	25	90	1700
HAE150-24S48WP	8.5 ~ 36	48	3	35	90	620
HAE150-48S3P3WP	16.5 ~ 75	3.3	40	15	89	121000
HAE150-48S05WP	16.5 ~ 75	5	30	15	91	60000
HAE150-48S12WP	16.5 ~ 75	12	13	20	91	10800
HAE150-48S15WP	16.5 ~ 75	15	10	20	91	6600
HAE150-48S24WP	16.5 ~ 75	24	6.5	20	91	2700
HAE150-48S28WP	16.5 ~ 75	28	5.5	20	91	1900
HAE150-48S48WP	16.5 ~ 75	48	3.2	25	91	660
HAE150-110S3P3WP	43 ~ 160	3.3	43	10	88	130000
HAE150-110S05WP	43 ~ 160	5	32	10	90	64000
HAE150-110S12WP	43 ~ 160	12	15	10	90	12500
HAE150-110S15WP	43 ~ 160	15	12	10	90	8000
HAE150-110S24WP	43 ~ 160	24	7.5	10	90	3100
HAE150-110S28WP	43 ~ 160	28	6.5	10	90	2300
HAE150-110S48WP	43 ~ 160	48	3.8	10	90	790

- "P" indicates Positive Logic
- For terminal block type, add -T to part number ( HAE150-48S24W-PT )



## PART NUMBER STRUCTURE

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range	Ctrl and Pin Options	SYNC Option	CASE pin Option	Through hole type <sup>(1)</sup>	Assembly Option
<b>HAE150 - 48 S 05 W - P Y C TH HS</b>	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	□:No pin Y:SYNC	□:No pin C:CASE pin	□: Thread TH: No thread	□: None <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.

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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		
		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		75		ms	
		Remote ON/OFF		75			
Input surge voltage	1 second, max.	24Vin(nom)			50	VDC	
		48Vin(nom)			100		
		110Vin(nom)			185		
Input filter <sup>(1)</sup>				Pi type			
Remote ON/OFF	Referred to –Vin pin	Negative logic (Standard)	DC-DC ON		Short or 0 ~ 1.2VDC		mA
			DC-DC OFF		Open or 3 ~ 12 VDC		
		Positive logic (Option)	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				
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)				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 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		
	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 (Reinforced insulation)	110Vin(nom)	3000			VAC
	1 minute (Basic insulation)	Others	1500			VDC
Isolation resistance	500VDC		1			GΩ
	500VDC				2500	pF
Switching frequency			225	250	275	kHz
Safety approvals						UL60950-1 EN60950-1 IEC60950-1
Case material	24Vin(nom) and 48Vin(nom)					Metal
Base material	110Vin(nom)		Aluminum base-plate with plastic case			
	24Vin(nom) and 48Vin(nom)		FR4 PCB			
			□□□□	T		
			□□□□	TF		
			□□□□	TF1		

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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 Others	-40 -55		+105 +125	°C
Thermal impedance <sup>(3)</sup>	Vertical direction by natural convection (20LFM) Module without 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		°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 <sup>(4)</sup>	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 <sup>(5)</sup>	EN61000-4-4 ±2kV		Perf. Criteria A
Surge <sup>(5)</sup>	EN61000-4-5 EN55024 ±2kV and EN50155 ±2kV		Perf. Criteria A
Conducted immunity	EN61000-4-6 10Vr.m.s		Perf. Criteria A
Power frequency magnetic field	EN61000-4-8 100A/m continuous; 1000A/m 1 second		Perf. Criteria A

## Notes:

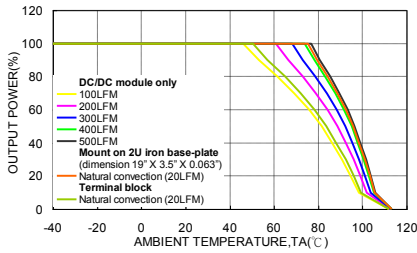
- Input source impedance: The power module will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module. Since real-world voltage source has finite impedance, performance can be improved by adding external filter capacitor.  
The HAE150-24S□□W and HAE150-48S□□W recommended Nippon Chemi-con KY series, 100µF/100V.  
The HAE150-110S□□W recommended Ruby-con BXF series, 68µF/200V.
- (1) Multiple HAE150W 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 HAE150W 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 EN61000-4-4, EN61000-4-5.  
The HAE150-24S□□W and HAE150-48S□□W recommended 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220µF/100V) to connect in parallel.  
The HAE150-110S□□W recommended 3 pcs of aluminum electrolytic capacitor (Ruby-con BXF series, 100µF/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 with P-DUKE.

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

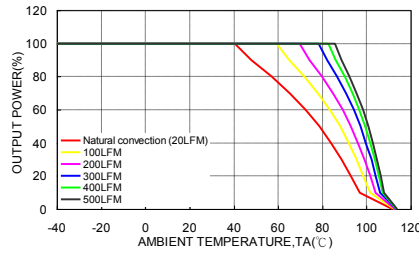
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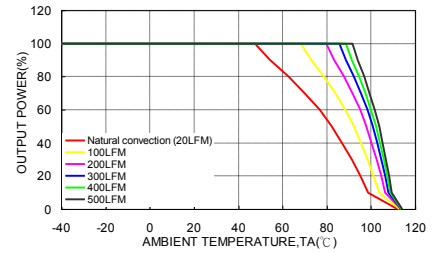
## CHARACTERISTIC CURVE



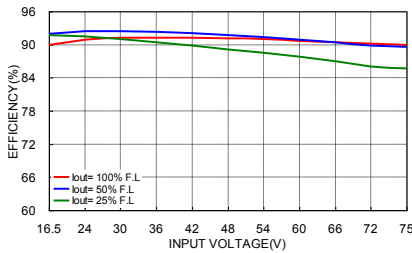
HAE150-48S05W Derating Curve (Note 3)



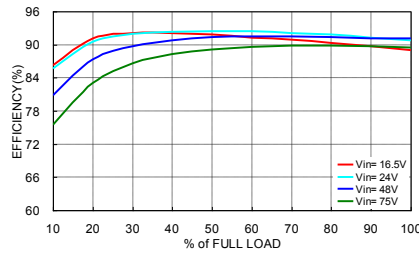
HAE150-48S05W Derating Curve (Note 3) With 0.24" Height Heat-sink



HAE150-48S05W Derating Curve (Note 3) With 0.45" Height Heat-sink



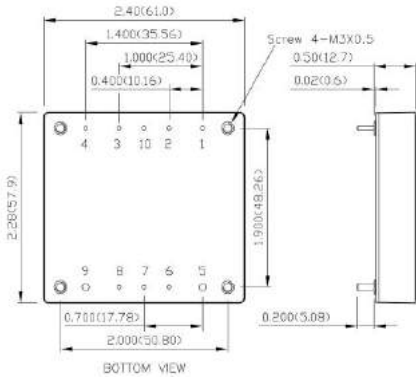
HAE150-48S05W Efficiency vs. Input Voltage



HAE150-48S05W Efficiency vs. Output Load

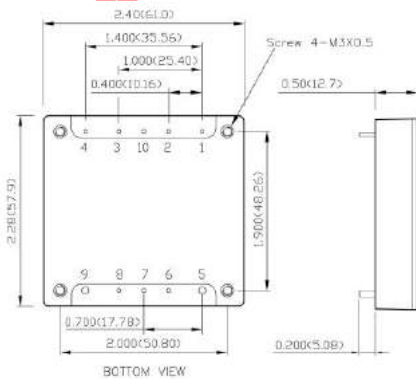
## MECHANICAL DRAWING - PCB Mounting

### HAE150-24S□□W, HAE150-48S□□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

### HAE150-110S□□W



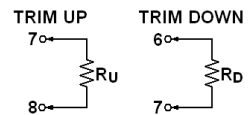
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)  
x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)
5. Mounting screws should always be used.
6. The screw locked torque:  
MAX 3.5kgf-cm/0.34N-m

## PIN CONNECTION

PIN	DEFINE	DIAMETER
1	-Vin	0.04 Inch
2	Case (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.



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

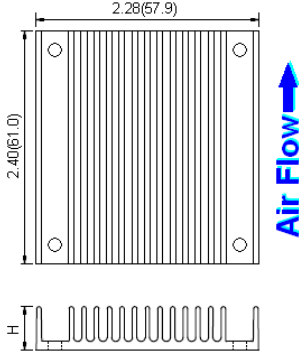
$$R_D = \left( \frac{100}{\Delta\%} - 2 \right) k\Omega$$

# HAE150W SERIES

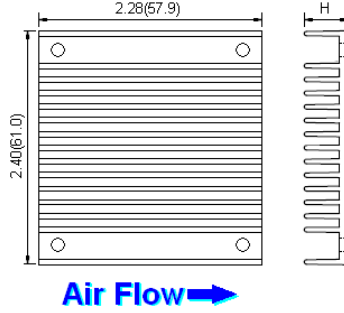
DC/DC Power Modules: 150 watts

## HEAT-SINK TYPE OPTIONS

Vertical Fin Orientation, Suffix:-HS, -HS2



Horizontal Fin Orientation, Suffix:-HS1, -HS3



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

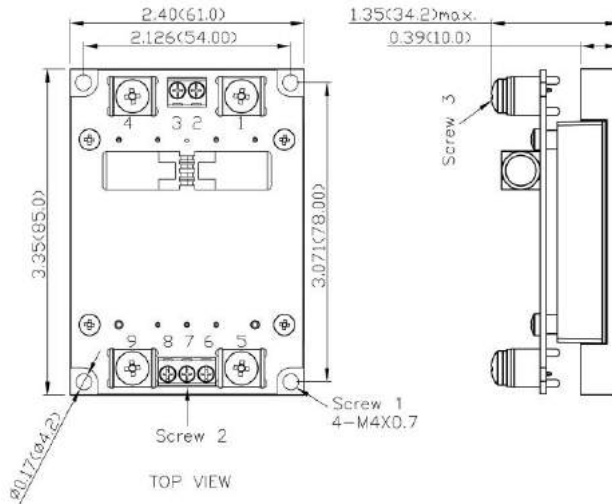
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)  
x.xxx±0.01 (x.xx±0.25)

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## TERMINAL BLOCK TYPE OPTIOBG

HAE150-□□S□□W-T fihUbxUXHYfa jbu'6`cW`L

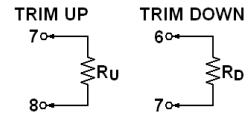


### TERMINAL CONNECTION

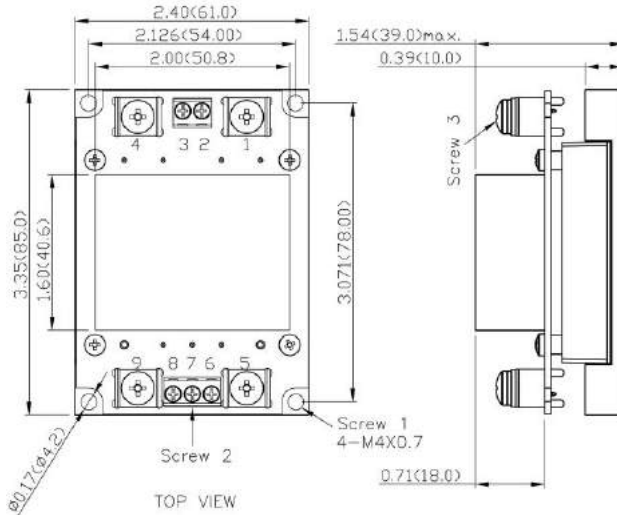
NO.	DEFINE
1	-Vin
2	NC
3	Ctrl
4	+Vin
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout

### EXTERNAL OUTPUT TRIMMING

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



HAE150-□□S□□W-TF fihYfa jbu'6`cW`k jh'9A7': jHf`L



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

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

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. Screw 1 locked torque:  
MAX 11.2kgf-cm/ 1.10N-m
4. Screw 2 locked torque:  
MAX 5.2kgf-cm/ 0.51N-m
5. Screw 3 locked torque:  
MAX 16.8kgf-cm/ 1.65N-m

HAE150-□□S□□W-TF1 fihYfa jbu'6`cW`k jh'9A7': jHf`L

