



P-DUKE POWER

HAE100 Series

Half-Brick DC-DC Converter
Up to 100 Watts

3
YEARS
WARRANTY

ROHS
COMPLIANT

REACH
COMPLIANT



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Medical



PV



Railway



3000
VDC
Isolation
Voltage

2 : 1
Input
Range

NO
Min. Load
Required

REMOTE
ON
OFF

OCP

OTP

OVP

SCP

UVP

PART NUMBER STRUCTURE

DIP Type:

HAE100-	48	S	05	-	P	HS
Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)		Ctrl and Pin Options	Assembly Options
	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; 0.20" pin length L:Negative logic; 0.145" pin length P:Positive logic; 0.20" pin length S:Positive logic; 0.145"pin length	□: None Heat-sink type HS: 7G-0021A-F; H=0.45" HS3: 7G-0024A-F; H=0.45" HS4: 7GA0127P01-F; H=0.65" HS5: 7GA0128P01-F; H=1" Through hole type TH: No thread* *The module can't equip Heat-sink with TH option.

Wall Mounted Type:

HAE100-	48	S	05	-	P	TF1	R
Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)		Ctrl and Pin Options	Assembly Options	Conformal Coating Options
	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; 0.20" pin length P:Positive logic; 0.20" pin length	T: Without EMC filter TF1: Integrated EMC filter and meets EN55032 Class A can be connected to PE	□: None R: Conformal Coating

1. The terminal block type is only for assembly of 0.20" pin length.

TECHNICAL SPECIFICATION All specifications are typical at nominal input, full load and 25°C unless 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
HAE100-12S3P3	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

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
	24Vin(nom)					18
	48Vin(nom)					36
Shutdown voltage	12Vin(nom)		7.3	7.7	8.1	VDC
	24Vin(nom)		15.5	16	16.3	
	48Vin(nom)		32.5	34	35.5	
Start up time	Constant resistive load	Power up				25
		Remote ON/OFF				25
Input surge voltage	1 second, max.	12Vin(nom)				36
		24Vin(nom)				50
		48Vin(nom)				100
Input filter						Pi type
Remote ON/OFF	Referred to -Vin pin	Negative logic (Standard)	DC-DC ON	Short or 0 ~ 1.2VDC		
		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 mA
		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 With a 4.7µF/50V X7R MLCC With a 4.7µF/50V X7R MLCC With a 4.7µF/50V X7R MLCC With a 2.2µF/100V X7R MLCC		3.3Vout, 5Vout 12Vout, 15Vout 24Vout, 28Vout 48Vout	75 100 200 300	mVp-p
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 Input to Output Input (Output) to Case	3000 1600			VDC
Isolation resistance	500VDC	1			GΩ
Isolation capacitance				2500	pF
Switching frequency		270	300	330	kHz
Safety approvals	IEC/ EN/ UL62368-1			UL:E193009 CB:UL(Demko)	
Case material					Metal
Base material					FR4 PCB
Potting material					Silicone (UL94 V-0)
Weight	Module stand alone HAE100-□□S□□-T HAE100-□□S□□-TF1			97g (3.42oz) 200g (7.05oz) 287g (10.12oz)	
MTBF	MIL-HDBK-217F, Full load				3.311×10 ⁵ hrs

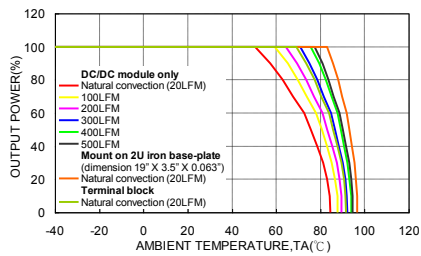
ENVIRONMENTAL SPECIFICATIONS					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating case temperature		-40		+105	°C
Maximum case temperature				105	°C
Over temperature protection			115		°C
Storage temperature range	Terminal block type Others	-40 -55		+105 +125	°C
Thermal impedance	Module without assembly option Heat-sink type with 0.45" Height Heat-sink type with 0.65" Height Heat-sink type with 1" Height		6.7 4.7 3.6 2.9		°C/W
Thermal shock					MIL-STD-810F
Vibration					MIL-STD-810F
Relative humidity					5% to 95% RH

EMC SPECIFICATIONS

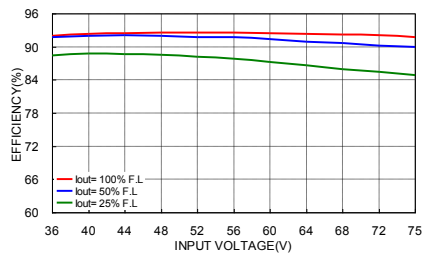
Parameter	Conditions		Level
EMI	EN55032	HAE100-□□S□□-TF1 Other models; with external components	Class A Class A, Class B
	*Connecting four screw bolts to shield plane will help to reduce the EMI.		
EMS	EN55035		
ESD	EN61000-4-2	Air ±8kV and Contact ±6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3	10V/m	Perf. Criteria A
Fast transient	EN61000-4-4	±2kV	Perf. Criteria A
		With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220µF/100V)	
Surge	EN61000-4-5	EN55035 ±2kV	Perf. Criteria A
		With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220µF/100V)	
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

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

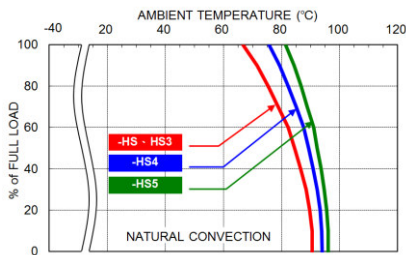
CHARACTERISTIC CURVE



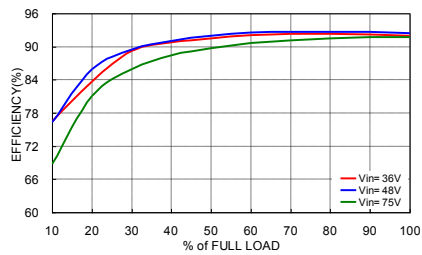
HAE100-48S05 Derating Curve
(See Thermal Considerations)



HAE100-48S05 Efficiency vs. Input Voltage



HAE100-48S05 Derating Curve with Heat-sink
(See Thermal Considerations)



HAE100-48S05 Efficiency vs. Output Load

FUSE CONSIDERATION

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

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.

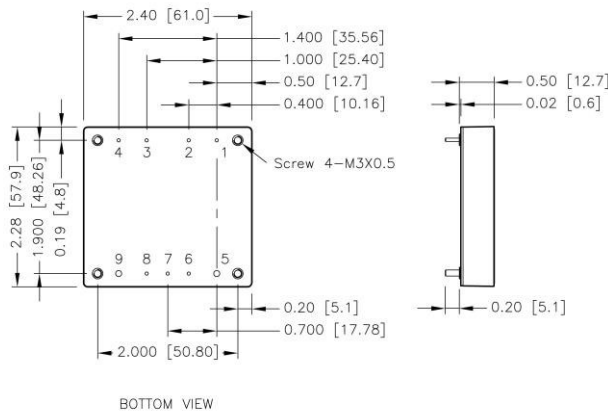
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below :

Model	Fuse Rating (A)	Fuse Type
HAE100-12S□□	20	Fast-Acting
HAE100-24S□□	10	Fast-Acting
HAE100-48S□□	5	Slow-Blow

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low V_{in} .

MECHANICAL DRAWING



PIN CONNECTION

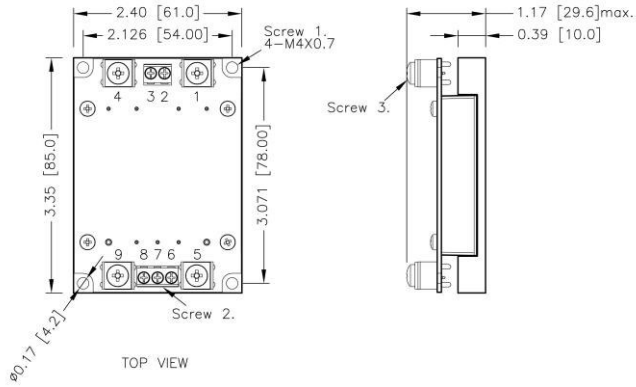
PIN	DEFINE	DIAMETER
1	-Vin	0.04 Inch
2	Case	0.04 Inch
3	Ctrl	0.04 Inch
4	+Vin	0.04 Inch
5	-Vout	0.08 Inch
6	-Sense	0.04 Inch
7	Trim	0.04 Inch
8	+Sense	0.04 Inch
9	+Vout	0.08 Inch

- All dimensions in inch [mm]
- Tolerance :x.xx±0.02 [x.x±0.5]
x.xxx±0.01 [x.xx±0.25]
- Pin dimension tolerance ±0.004[0.10]

- The screw locked torque: MAX 5.0kgf-cm(0.49N-m)

TERMINAL BLOCK TYPE OPTION

HAE100-□□S□□-T

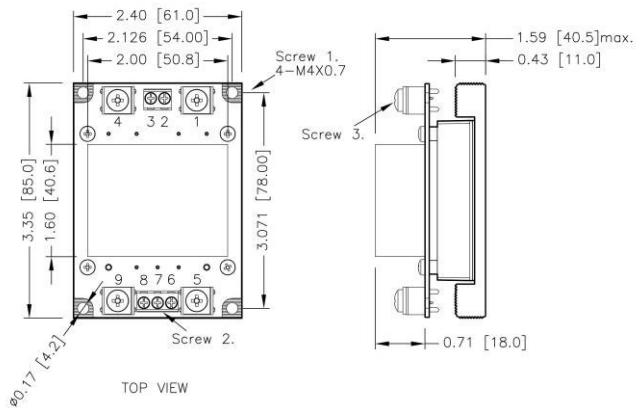


TERMINAL CONNECTION : -T

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

- All dimensions in inch [mm]
- Tolerance : $x.xx \pm 0.02$ [$x.x \pm 0.5$]
 $x.xxx \pm 0.01$ [$x.xx \pm 0.25$]
- Screw 1 locked torque:
MAX 11.2kgf-cm/ 1.10N-m
- Screw 2 locked torque:
MAX 5.2kgf-cm/ 0.51N-m
- Screw 3 locked torque:
MAX 12.0kgf-cm/ 1.18N-m

HAE100-□□S□□-TF1

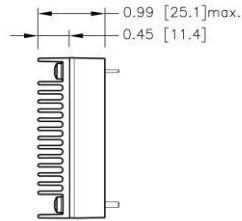
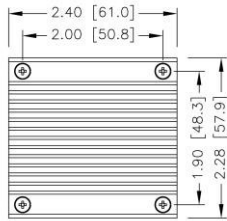


TERMINAL CONNECTION : -TF1

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

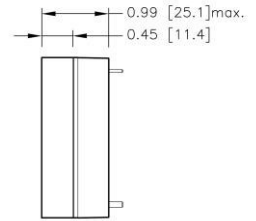
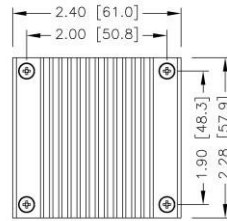
HEAT-SINK TYPE OPTIONS

HAE100-□□S□□-**HS**
7G-0021A-F



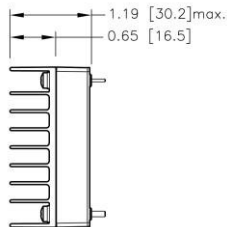
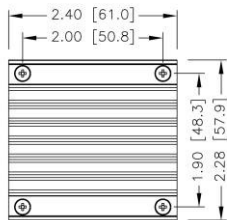
SIDE VIEW

HAE100-□□S□□-**HS3**
7G-0024A-F



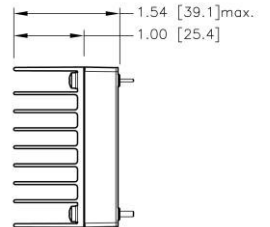
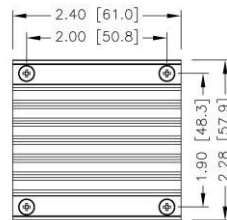
SIDE VIEW

HAE100-□□S□□-**HS4**
7GA0127P01-F



SIDE VIEW

HAE100-□□S□□-**HS5**
7GA0128P01-F



SIDE VIEW

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

OUTPUT VOLTAGE ADJUSTMENT

Output voltage is adjustable for 10% trim up or -20% trim down of nominal output voltage by connecting an external resistor between the Trim pin and either the +Sense or -Sense pins.

With an external resistor between the Trim and -Sense pin, the output voltage set point decreases.

With an external resistor between the Trim and +Sense pin, the output voltage set point increases.

Maximum output deviation is +10% inclusive of remote sense.

The external TRIM resistor needs to be at least 1/8W of rated power.

Trim Up Equation

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

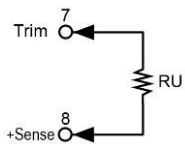
Trim Down Equation

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

EXTERNAL OUTPUT TRIMMING

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

Trim-up



□□S3P3

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.630
RU (kΩ)	170.082	85.388	57.156	43.041	34.571	28.925	24.892	21.867	19.515	17.633

□□S05

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.40	5.45	5.50
RU (kΩ)	310.245	156.163	104.803	79.122	63.714	53.442	46.105	40.602	36.322	32.898

□□S12

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20
RU (kΩ)	887.388	447.592	300.993	227.694	183.714	154.395	133.452	117.745	105.528	95.755

□□S15

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50
RU (kΩ)	1134.735	572.490	385.075	291.367	235.143	197.660	170.886	150.806	135.188	122.694

□□S24

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	24.24	24.48	24.72	24.96	25.20	25.44	25.68	25.92	26.16	26.40
RU (kΩ)	1876.776	947.184	637.320	482.388	389.429	327.456	283.190	249.990	224.168	203.510

□□S28

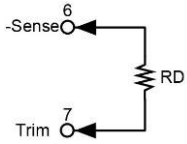
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	28.28	28.56	28.84	29.12	29.40	29.68	29.96	30.24	30.52	30.80
RU (kΩ)	2206.571	1113.714	749.429	567.286	458.000	385.143	333.102	294.071	263.714	239.429

□□S48

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	48.48	48.96	49.44	49.92	50.40	50.88	51.36	51.84	52.32	52.80
RU (kΩ)	3855.551	1946.367	1309.973	991.776	800.857	673.578	582.665	514.480	461.447	419.020

OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

Trim-down



□□S□□

ΔV (%)	1	2	3	4	5	6	7	8	9	10
RD (k Ω)	98.000	48.000	31.333	23.000	18.000	14.667	12.286	10.500	9.111	8.000
ΔV (%)	11	12	13	14	15	16	17	18	19	20
RD (k Ω)	7.091	6.333	5.692	5.143	4.667	4.250	3.882	3.556	3.263	3.000