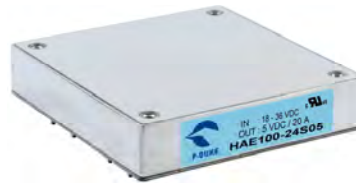


HAE100 SERIES

HALF-BRICK DC-DC CONVERTER



2:1 WIDE INPUT RANGE
UP TO 100 Watts



FEATURES

- NO MINIMUM LOAD REQUIRED
- 2250VDC INPUT TO OUTPUT BASIC INSULATION
- UL60950-1, EN60950-1, & IEC60950-1 SAFETY APPROVALS
- CE MARKED
- COMPLIANT TO RoHS II & REACH

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
	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

PART NUMBER STRUCTURE

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Ctrl and Pin Options	Through hole type ⁽¹⁾	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	□: None 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 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		25		ms
Input surge voltage	1 second, max.	12Vin(nom)		36	VDC
		24Vin(nom)		50	
		48Vin(nom)		100	
Input filter			Pi type		
Remote ON/OFF	Referenced to -Vin 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

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 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)	2250			VDC
		1600			
Isolation resistance	500VDC	1			GΩ
Isolation capacitance				2500	pF
Switching frequency		270	300	330	kHz
Safety approvals					UL60950-1 EN60950-1 IEC60950-1
Case material					Metal
Base material					FR4 PCB
Potting material					Silicone (UL94 V-0)
Weight	Module stand alone				97g (3.42oz)
	HAE100-□□S□□-T				200g (7.05oz)
	HAE100-□□S□□-TF				280g (9.88oz)
	HAE100-□□S□□-TF1				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
Over temperature protection			+115		°C
Storage temperature range	Terminal block type Others	-40 -55		+105 +125	°C
Thermal impedance ⁽¹⁾	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
Vibration					MIL-STD-810F
Relative humidity					5% to 95% RH

EMC SPECIFICATIONS

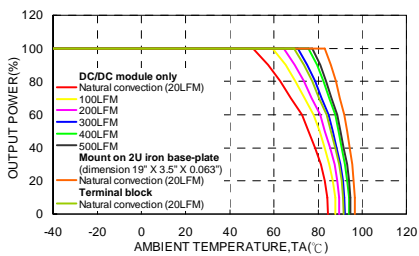
Parameter	Conditions	Level
EMI ⁽²⁾	EN55022	Class A Class B
ESD	EN61000-4-2 Air ±8kV and Contact ±6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3 10V/m	Perf. Criteria A
Fast transient ⁽³⁾	EN61000-4-4 ±2kV	Perf. Criteria A
Surge ⁽³⁾	EN61000-4-5 EN55024 ±2kV	Perf. Criteria A
Conducted immunity	EN61000-4-6 10Vr.m.s	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8 100A/m continuous; 1000A/m 1 second	Perf. Criteria A

Note:

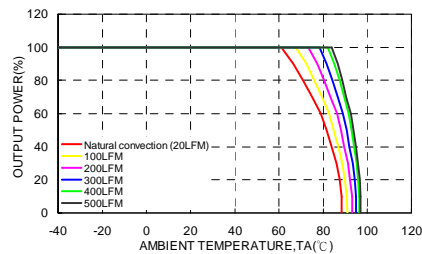
- (1) Thermal test condition with vertical direction by natural convection (20LFM).
- (2) The heat-sink is optional and P/N: 7G-0021A-F, 7G-0022A-F, 7G-0023A-F, 7G-0024A-F. Please refer to heat-sink selection guide.
- The HAE100 series standard module meets EN55022 Class A and Class B with external components.
- 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 : 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.

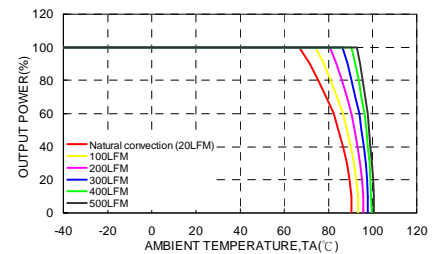
CHARACTERISTIC CURVE



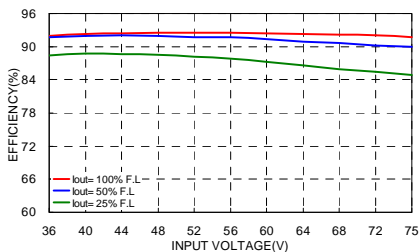
HAE100-48S05 Derating Curve (Note 1)



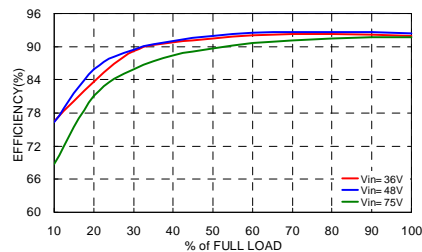
HAE100-48S05 Derating Curve (Note 1)
With 0.24" Height Heat-sink



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

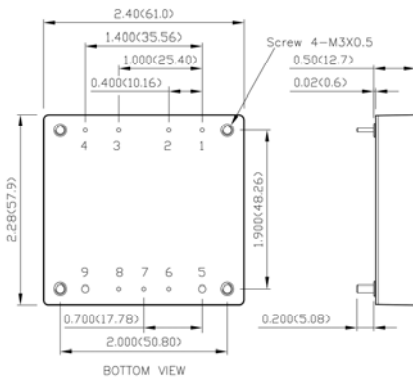


HAE100-48S05 Efficiency vs. Input Voltage



HAE100-48S05 Efficiency vs. Output Load

MECHANICAL DRAWING



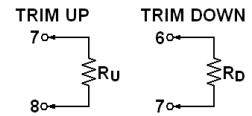
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)
x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)
5. Mounting screws should always be used.
6. The screw locked torque:
MAX 5.0kgf-cm(0.49N-m)

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.

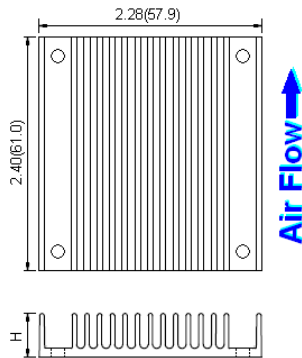


$$R_U = \left(\frac{V_{OUT} (100 + \Delta\%)}{1.225 \Delta\%} - \frac{(100 + 2\Delta\%)}{\Delta\%} \right) k\Omega$$

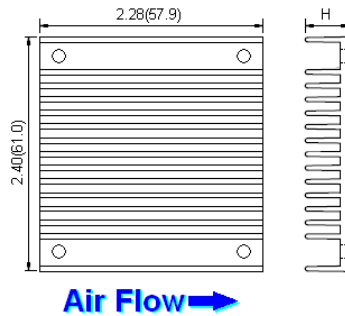
$$R_D = \left(\frac{100}{\Delta\%} - 2 \right) k\Omega$$

HEAT-SINK TYPE OPTIONS

Vertical Fin Orientation, Suffix: -HS, -HS2



Horizontal Fin Orientation, Suffix: -HS1, -HS3

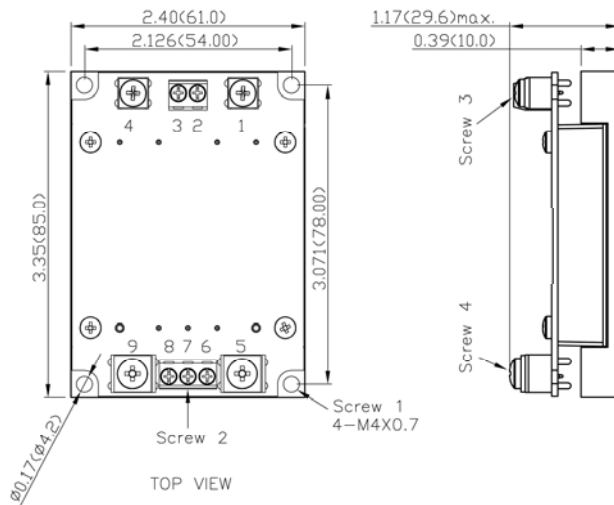


HS:	Height H=0.45" vertical fin, 7G-0021A-F
HS1:	Height H=0.24" horizontal fin, 7G-0022A-F
HS2:	Height H=0.24" vertical fin, 7G-0023A-F
HS3:	Height H=0.45" horizontal fin, 7G-0024A-F

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

HAE100-□□S□□-T

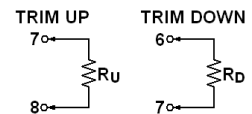


TERMINAL CONNECTION : -T,-TF

NO.	DEFINE
1	-Vin
2	Case
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.

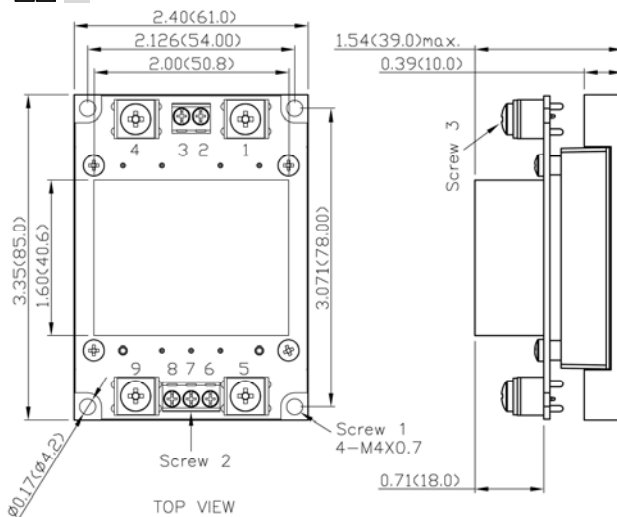


$$R_U = \left(\frac{V_{OUT} (100 + \Delta\%)}{1.225 \Delta\%} - \frac{(100 + 2\Delta\%) }{\Delta\%} \right) k\Omega$$

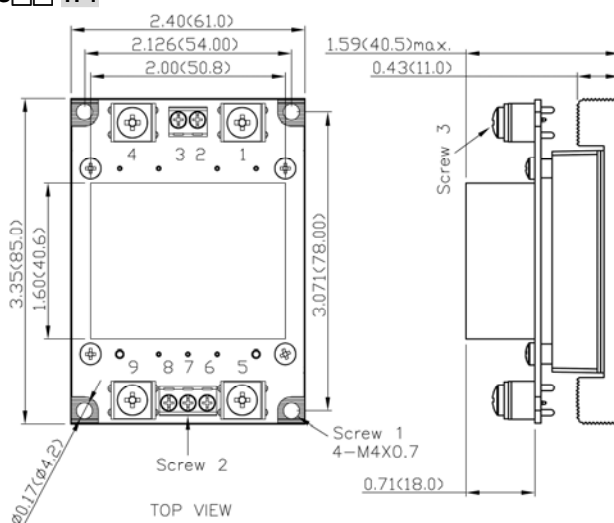
$$R_D = \left(\frac{100}{\Delta\%} - 2 \right) k\Omega$$

- All dimensions in inch (mm)
- Tolerance : x.xx±0.02 (x.x±0.5)
x.xxx±0.01 (x.xx±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, 4 locked torque:
MAX 12.0kgf-cm/ 1.18N-m

HAE100-□□S□□-TF



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