



# P-DUKE POWER

## HAE75W Series

Half-Brick DC-DC Converter  
Up to 75 Watts

**3**  
YEARS  
WARRANTY

ROHS  
COMPLIANT

REACH  
COMPLIANT



Railway



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Medical



PV

UL US

CB CE

**3000**  
VAC  
Reinforced  
Insulation

**2250**  
VDC  
Basic  
Insulation

**4 : 1**  
Wide  
Input  
Range

**NO**  
Min. Load  
Required

**REMOTE**  
**ON**  
**OFF**

**OCP**

**OTP**

**OVP**

**SCP**

**UVP**

### PART NUMBER STRUCTURE

DIP Type:

| HAE75       | - | 48                                | S               | 05                                                           | W           | - | P                                                                                                                                                                  | HS                                                                                                                                                                                           |
|-------------|---|-----------------------------------|-----------------|--------------------------------------------------------------|-------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Series Name |   | Input Voltage (VDC)               | Output Quantity | Output Voltage (VDC)                                         | Input Range |   | Ctrl and Pin Options                                                                                                                                               | Assembly Option                                                                                                                                                                              |
|             |   | 24:9~36<br>48:18~75<br>110:43~160 | S:Single        | 3P3:3.3<br>05:5<br>12:12<br>15:15<br>24:24<br>28:28<br>48:48 | 4:1         |   | □:Negative logic;<br>0.20" pin length<br>L:Negative logic;<br>0.145" pin length<br>P:Positive logic;<br>0.20" pin length<br>S:Positive logic;<br>0.145" pin length | □: None<br><b>Through hole type</b><br>TH:No thread<br><br><b>Heat-sink type:</b><br>HS:7G-0021A-F; H=0.45"<br>HS1:7G-0022A-F; H=0.24"<br>HS2:7G-0023A-F; H=0.24"<br>HS3:7G-0024A-F; H=0.45" |

1. The module can't equip Heat-sink with TH option.

Wall Mounted Type:

| HAE75       | - | 48                                | S               | 05                                                           | W           | - | P                                                                              | TF                                                                                                                                                                                 |
|-------------|---|-----------------------------------|-----------------|--------------------------------------------------------------|-------------|---|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Series Name |   | Input Voltage (VDC)               | Output Quantity | Output Voltage (VDC)                                         | Input Range |   | Ctrl and Pin Options                                                           | Assembly Option                                                                                                                                                                    |
|             |   | 24:9~36<br>48:18~75<br>110:43~160 | S:Single        | 3P3:3.3<br>05:5<br>12:12<br>15:15<br>24:24<br>28:28<br>48:48 | 4:1         |   | □:Negative logic;<br>0.20" pin length<br>P:Positive logic;<br>0.20" pin length | T: Without EMC filter<br><b>TF:</b> Integrated EMC filter<br>and meets EN55032 Class A<br><b>TF1:</b> Integrated EMC filter<br>and meets EN55032 Class A<br>can be connected to PE |

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                     |
| HAE75-24S3P3W  | 9 ~ 36      | 3.3            | 20                        | 85                      | 87         | 60600                  |
| HAE75-24S05W   | 9 ~ 36      | 5              | 15                        | 120                     | 88         | 30000                  |
| HAE75-24S12W   | 9 ~ 36      | 12             | 6.3                       | 185                     | 88         | 5250                   |
| HAE75-24S15W   | 9 ~ 36      | 15             | 5                         | 185                     | 88         | 3330                   |
| HAE75-24S24W   | 9 ~ 36      | 24             | 3.2                       | 85                      | 87         | 1330                   |
| HAE75-24S28W   | 9 ~ 36      | 28             | 2.7                       | 85                      | 87         | 960                    |
| HAE75-24S48W   | 9 ~ 36      | 48             | 1.6                       | 85                      | 87         | 330                    |
| HAE75-48S3P3W  | 18 ~ 75     | 3.3            | 20                        | 60                      | 88         | 60600                  |
| HAE75-48S05W   | 18 ~ 75     | 5              | 15                        | 60                      | 90         | 30000                  |
| HAE75-48S12W   | 18 ~ 75     | 12             | 6.3                       | 90                      | 90         | 5250                   |
| HAE75-48S15W   | 18 ~ 75     | 15             | 5                         | 50                      | 89         | 3330                   |
| HAE75-48S24W   | 18 ~ 75     | 24             | 3.2                       | 50                      | 88         | 1330                   |
| HAE75-48S28W   | 18 ~ 75     | 28             | 2.7                       | 50                      | 88         | 960                    |
| HAE75-48S48W   | 18 ~ 75     | 48             | 1.6                       | 50                      | 87         | 330                    |
| HAE75-110S3P3W | 43 ~ 160    | 3.3            | 20                        | 10                      | 89         | 60600                  |
| HAE75-110S05W  | 43 ~ 160    | 5              | 15                        | 10                      | 91         | 30000                  |
| HAE75-110S12W  | 43 ~ 160    | 12             | 6.3                       | 10                      | 91         | 5250                   |
| HAE75-110S15W  | 43 ~ 160    | 15             | 5                         | 10                      | 91         | 3330                   |
| HAE75-110S24W  | 43 ~ 160    | 24             | 3.2                       | 10                      | 90         | 1330                   |
| HAE75-110S28W  | 43 ~ 160    | 28             | 2.7                       | 10                      | 90         | 960                    |
| HAE75-110S48W  | 43 ~ 160    | 48             | 1.6                       | 10                      | 90         | 330                    |

| INPUT SPECIFICATIONS          |                         |                           |             |                     |      |      |      |
|-------------------------------|-------------------------|---------------------------|-------------|---------------------|------|------|------|
| Parameter                     | Conditions              |                           |             | Min.                | Typ. | Max. | Unit |
| Operating input voltage range | 24Vin(nom)              |                           |             | 9                   | 24   | 36   | VDC  |
|                               | 48Vin(nom)              |                           |             | 18                  | 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                 | 7.7  | 8.1  | VDC  |
|                               | 48Vin(nom)              |                           |             | 15.5                | 16   | 16.3 |      |
|                               | 110Vin(nom)             |                           |             | 33.0                | 34.5 | 36.0 |      |
| Start up time                 | Constant resistive load | Power up                  | 110Vin(nom) | 60                  |      |      | ms   |
|                               |                         |                           | Others      | 25                  |      |      |      |
|                               |                         | Remote ON/OFF             | 110Vin(nom) | 60                  |      |      |      |
|                               |                         |                           | Others      | 25                  |      |      |      |
| 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            | 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                | 1    |      |      |
|                               |                         | Remote off input current  |             |                     | 3    |      |      |

## 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)<br>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<br>With a 4.7μF/50V X7R MLCC<br>With a 4.7μF/50V X7R MLCC<br>With a 4.7μF/50V X7R MLCC<br>With a 2.2μF/100V X7R MLCC |       | 75<br>100<br>200<br>300 | 100<br>125<br>250<br>350 | 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<br>110Vin(nom)<br>Others                                                                                            |       | 150                     |                          | %                              |
| Short circuit protection         |                                                                                                                                                  |       |                         |                          | Continuous, automatic recovery |

## GENERAL SPECIFICATIONS

| Parameter             | Conditions                                                                            | Min.         | Typ. | Max.                                                             | Unit                                           |
|-----------------------|---------------------------------------------------------------------------------------|--------------|------|------------------------------------------------------------------|------------------------------------------------|
| Isolation voltage     | 1 minute(Reinforced insulation) 110Vin(nom) Input to Output<br>Input (Output) to Case | 3000<br>1500 |      |                                                                  | VAC                                            |
|                       | 1 minute(Basic insulation) Others Input to Output<br>Input (Output) to Case           | 2250<br>1600 |      |                                                                  | VDC                                            |
| Isolation resistance  | 500VDC                                                                                | 1            |      |                                                                  | GΩ                                             |
| Isolation capacitance |                                                                                       |              |      | 2500                                                             | pF                                             |
| Switching frequency   |                                                                                       | 270          | 300  | 330                                                              | kHz                                            |
| Safety approvals      | IEC /UL/ EN60950-1                                                                    |              |      | UL:E193009<br>CB:UL(Demko)                                       |                                                |
| Standard approvals    | EN50155<br>EN45545-2                                                                  |              |      |                                                                  |                                                |
| Case material         | 24Vin(nom) and 48Vin(nom)<br>110Vin(nom)                                              |              |      |                                                                  | Metal<br>Aluminum base-plate with plastic case |
| Base material         | 24Vin(nom) and 48Vin(nom)                                                             |              |      |                                                                  | FR4 PCB                                        |
| Potting material      |                                                                                       |              |      |                                                                  | Silicone (UL94 V-0)                            |
| Weight                | Module stand alone<br>HAE75-□□S□□W -T<br>HAE75-□□S□□W -TF<br>HAE75-□□S□□W -TF1        |              |      | 97g (3.42oz)<br>200g (7.05oz)<br>280g (9.88oz)<br>287g (10.12oz) |                                                |
| MTBF                  | MIL-HDBK-217F, Full load                                                              |              |      |                                                                  | 3.362×10 <sup>5</sup> hrs                      |

## ENVIRONMENTAL SPECIFICATIONS

| Parameter                   | Conditions                                                                                             | Min. | Typ.              | Max. | Unit                  |
|-----------------------------|--------------------------------------------------------------------------------------------------------|------|-------------------|------|-----------------------|
| Operating case temperature  | Base-plate                                                                                             | -40  |                   | +105 | °C                    |
| Maximum case temperature    |                                                                                                        |      |                   | +105 | °C                    |
| Over temperature protection |                                                                                                        |      | +115              |      | °C                    |
| Storage temperature range   | Terminal block type                                                                                    | -40  |                   | +105 | °C                    |
|                             | Others                                                                                                 | -55  |                   | +125 | °C                    |
| Thermal impedance           | Module without assembly option<br>Heat-sink type with 0.24" Height<br>Heat-sink type with 0.45" Height |      | 6.7<br>5.4<br>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

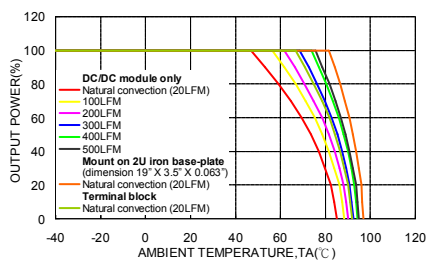
| Parameter                      | Conditions                                                                |                                                                                         | Level                                  |
|--------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------------------|
| EMI                            | EN55011, EN55032                                                          | HAE75-□□S□□W-TF<br>HAE75-□□S□□W-TF1<br>Other models; with external components           | Class A<br>Class A<br>Class A, Class B |
|                                | *Connecting four screw bolts to shield plane will help to reduce the EMI. |                                                                                         |                                        |
| ESD                            | EN61000-4-2                                                               | Air ± 8kV and Contact ± 6kV                                                             | Perf. Criteria A                       |
| Radiated immunity              | EN61000-4-3                                                               | 20V/m                                                                                   | Perf. Criteria A                       |
| Fast transient                 | EN61000-4-4                                                               | ± 2kV                                                                                   | Perf. Criteria A                       |
|                                | HAE75-24S□□W<br>HAE75-48S□□W                                              | With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220μF/100V)  |                                        |
|                                | HAE75-110S□□W                                                             | With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KXJ series, 150μF/200V) |                                        |
| Surge                          | EN61000-4-5                                                               | EN55024 ±2kV and EN50155 ±2kV                                                           | Perf. Criteria A                       |
|                                | HAE75-24S□□W<br>HAE75-48S□□W                                              | With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220μF/100V)  |                                        |
|                                | HAE75-110S□□W                                                             | With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KXJ series, 150μF/200V) |                                        |
| 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:

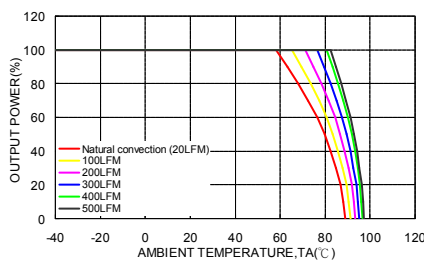
- Input source impedance: The power module will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module. Since real-world voltage source has finite impedance, performance can be improved by adding external filter capacitor. The HAE75-24S□□W recommended 4.7μF/50V X7R MLCC or Nippon Chemi-con KY series, 68μF /100V or better capacitor.

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

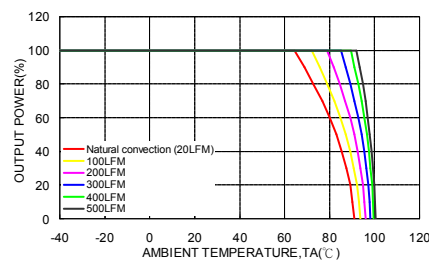
## CHARACTERISTIC CURVE



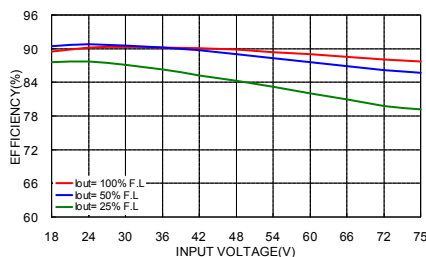
HAE75-48S05W Derating Curve  
(See Thermal Considerations)



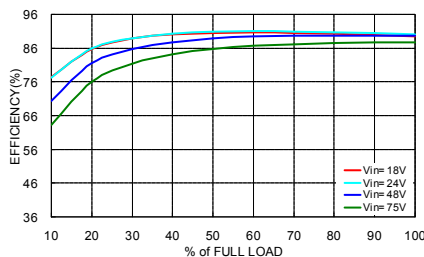
HAE75-48S05W Derating Curve  
With 0.24" Height Heat-sink  
(See Thermal Considerations)



HAE75-48S05W Derating Curve  
With 0.45" Height Heat-sink  
(See Thermal Considerations)



HAE75-48S05W Efficiency vs. Input Voltage



HAE75-48S05W 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.

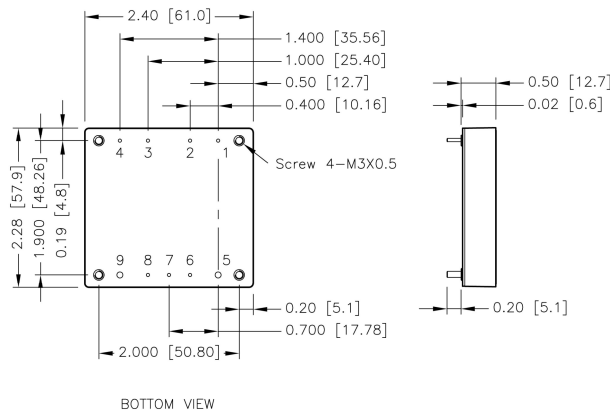
The input line fuse suggest as below :

| Model         | Fuse Rating (A) | Fuse Type |
|---------------|-----------------|-----------|
| HAE75-24S□□W  | 15              | Fast-Blow |
| HAE75-48S□□W  | 8               | Fast-Blow |
| HAE75-110S□□W | 3.15            | Slow-Blow |

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

## MECHANICAL DRAWING

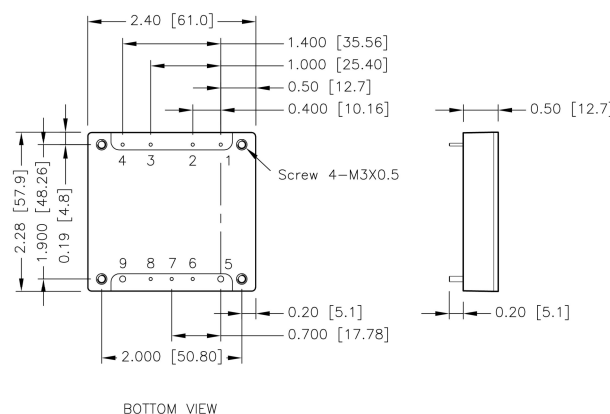
### HAE75-24S□□W, HAE75-48S□□W



BOTTOM VIEW

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

### HAE75-110S□□W



BOTTOM VIEW

- The screw locked torque: MAX 3.5kgf-cm/0.34N-m

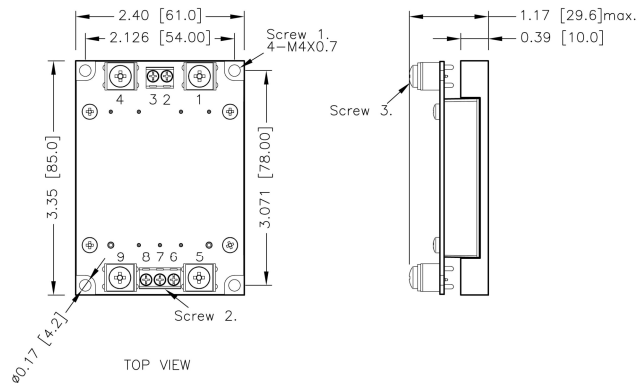
### PIN CONNECTION

| 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 |

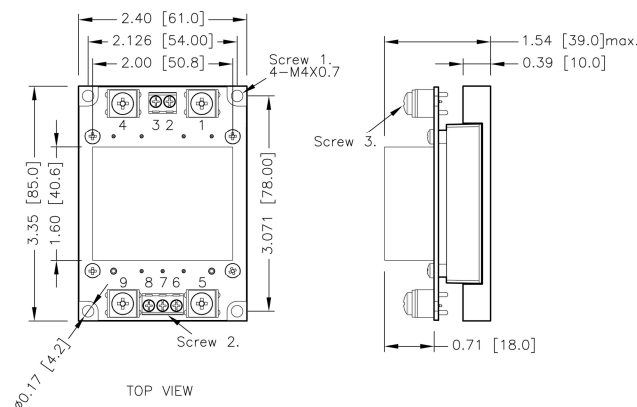
1. All dimensions in inch [mm]
2. Tolerance : x.xx±0.02 [x.x±0.5]  
x.xxx±0.01 [x.xx±0.25]
3. Pin pitch tolerance ±0.01 [0.25]
4. Pin dimension tolerance ±0.004[0.10]

## TERMINAL BLOCK TYPE OPTION

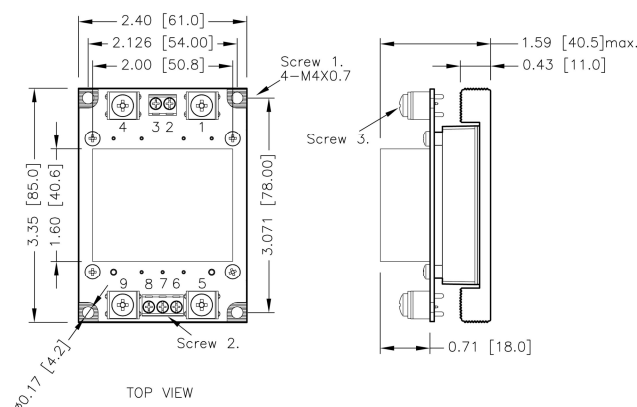
### HAE75-□□S□□W -T



### HAE75-□□S□□W -TF



### HAE75-□□S□□W -TF1



### TERMINAL CONNECTION : -T, -TF

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

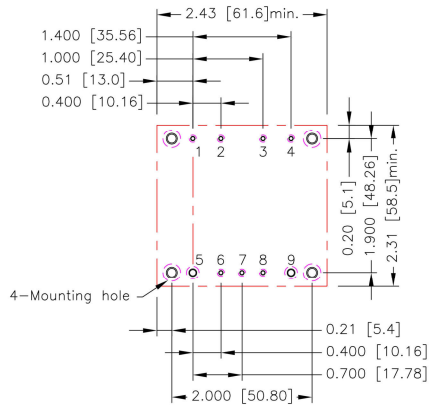
\* Terminal 2 is "NC" for HAE75-110S□□W-TF

1. All dimensions in inch [mm]
2. Tolerance :  $x.xx \pm 0.02$  [ $x.x \pm 0.5$ ]  
 $x.xxx \pm 0.01$  [ $x.xx \pm 0.25$ ]
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 12.0kgf-cm/ 1.18N-m

### TERMINAL CONNECTION : -TF1

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

### RECOMMENDED PAD LAYOUT



All dimensions in inch[mm]  
 Pad size(lead free recommended)  
 Through hole 1,2,3,4,6,7,8:  $\Phi 0.051[\Phi 1.30]$   
 Through hole 5,9:  $\Phi 0.091[\Phi 2.30]$   
 Through hole of mounting:  $\Phi 0.126[\Phi 3.20]$   
 Top view pad 1,2,3,4,6,7,8:  $\Phi 0.064[\Phi 1.63]$   
 Top view pad 5,9:  $\Phi 0.113[\Phi 2.88]$   
 Top view pad of mounting:  $\Phi 0.157[\Phi 4.00]$   
 Bottom view pad 1,2,3,4,6,7,8:  $\Phi 0.102[2.60]$   
 Bottom view pad 5,9:  $\Phi 0.181[4.60]$   
 Bottom view pad of mounting:  $\Phi 0.252[6.40]$

### THERMAL CONSIDERATIONS

The power module operates in a variety of thermal environments.

However, sufficient cooling should be provided to help ensure reliable operation of the unit.

Heat is removed by conduction, convection, and radiation to the surrounding Environment.

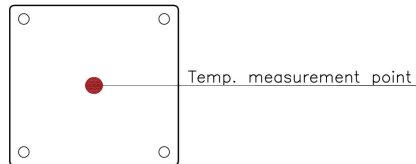
Proper cooling can be verified by measuring the point as the figure below.

The temperature at this location should not exceed "Maximum case temperature".

When Operating, adequate cooling must be provided to maintain the test point temperature at or below "Maximum case temperature".

You can limit this Temperature to a lower value for extremely high reliability.

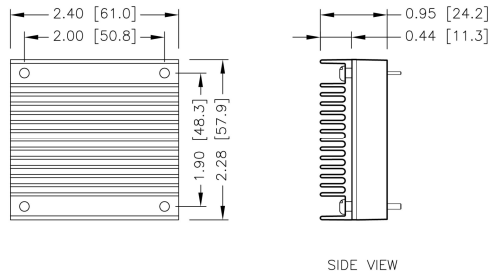
- Thermal test condition with vertical direction by natural convection (20LFM).
- The heat-sink is optional and P/N: 7G-0021A-F , 7G-0022A-F , 7G-0023A-F , 7G-0024A-F.



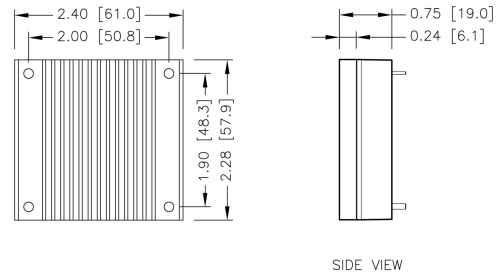
BASE PLATE

## HEAT-SINK TYPE OPTIONS

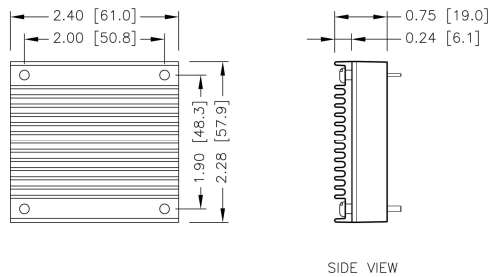
HAE75-□□S□□W-**HS**  
7G-0021A-F



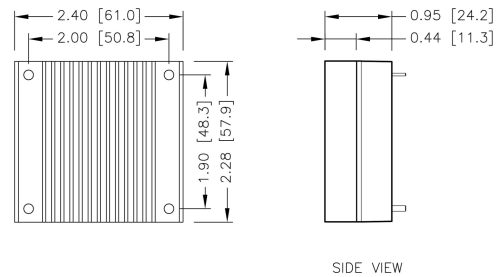
HAE75-□□S□□W-**HS1**  
7G-0022A-F



HAE75-□□S□□W-**HS2**  
7G-0023A-F



HAE75-□□S□□W-**HS3**  
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]



## 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

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

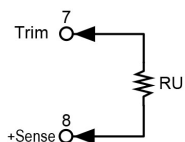
### Trim Down Equation

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

## EXTERNAL OUTPUT TRIMMING

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

Trim-up



### □□S3P3W

| 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 |

### □□S05W

| 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 |

### □□S12W

| 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 |

### □□S15W

| 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 |

### □□S24W

| 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 |

### □□S28W

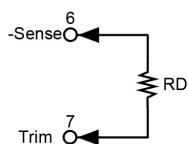
| ΔV (%)   | 1        | 2        | 3       | 4       | 5       | 6       | 7       | 8       | 9       | 10      |
|----------|----------|----------|---------|---------|---------|---------|---------|---------|---------|---------|
| Vout (V) | 28.28    | 28.56    | 28.84   | 29.12   | 29.40   | 29.68   | 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 |

### □□S48W

| 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□□W

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