

# HAE200W SERIES

DC / DC Single Output: 200 Watts



PCB Model

Terminal Block Model

## Features

- 4:1 wide Input range options: 9~36V, 18~75V & 43~160V
- Rail EN50155 compliance pending
- Single output options, 3.3 ~ 48vdc
- Industry Standard Half-Brick package
- High efficiency up to 90%
- Regulated output & Short circuit protection
- 2250VDC isolation
- Five sided continuous copper shield
- Remote ON / OFF, Negative or Positive Logic
- High operating base plate temperature : -40°to +115°C
- Zero load operation
- External Output voltage trim +10% to -20%
- Terminal block option –T ( see options )
- A range of heatsink options ( see options page )

## Specifications:

<b>Input Voltage</b>	<b>24VDC</b> ( 9 ~ 36 ), <b>48VDC</b> ( 18 ~ 75 ) <b>110VDC</b> ( 43~160 )	<b>Efficiency</b>	Model dependant 86 ~ 91%
<b>Input Filter</b>	Pi type ( see note 12 )	<b>Isolation</b>	Input – Output: 2250VDC Input / Output – Case: 1600VDC
<b>Start-up Voltage</b>	24V input: 9V typ, 48V input: 18V typ. 110V input: 43V	<b>Isolation Cap.</b>	2500pF
<b>Shutdown Voltage</b>	24V input: 7~8V, 48V input: 15.5~16.5V 110V input: 33~36V	<b>Switching Freq.</b>	250KHz
<b>Input Surge Voltage.</b>	24V: 50VDC. 48V: 100VDC 110V: 185VDC ( 1 sec max )	<b>Safety</b>	EN60950-1, UL60950-1, EN50155 ( pending)
<b>Input Reverse Voltage Protection</b>	External input fuse required	<b>Case Material</b>	Metal ( 24 & 48V input ) Aluminum base, plastic case ( 110V input )
<b>Start Up time</b>	Typically 75mS constant resistive load	<b>Base Material</b>	FR4 PCB ( 24 & 48V )
<b>Sync Pin</b>	-0.3~5.6V ( see note 13 )	<b>Potting</b>	Epoxy UL94-V0
<b>Remote ON/OFF</b> note 5 Negative Logic-Standard	DC-DC ON Short or $0V < V_r < 1.2V$ DC-DC OFF Open or $3.0V < V_r < 12V$	<b>Dimensions</b>	61 X 57.9 X 12.7mm
( Positive Logic -P )	DC-DC ON Open or $3.0V < V_r < 12V$ DC-DC OFF Short or $0V < V_r < 1.2V$	<b>Weight</b>	105g
	Input current of remote control pin: 0.5~1mA. Remote off state input current: 3mA	<b>MTBF</b>	7.416 x 104Hrs ( MIL-HDBK-217F )
<b>Output power</b>	165~ 240 watts	<b>Operating Base Plate Temperature</b>	-40°C to +115°C maximum base temperature
<b>Voltage Accuracy</b>	±1.0%	<b>Over Temp. Protection</b>	Shutdown approx 120°C base temperature
<b>Voltage Trim</b>	+10% to -20% External voltage trim	<b>Thermal Impedance</b>	6.1°C / watt without heatsink 5.1°C / watt with 0.24" height optional heatsink 4.6°C / watt with 0.45" height optional heatsink 2.8°C / watt with iron base plate
<b>Minim Load</b>	Zero	<b>Thermal shock</b>	MIL-STD-810F & EN61373
<b>Line Regulation</b>	See table	<b>Vibration</b>	MIL-STD-810F & EN61373
<b>Load Regulation</b>	See table	<b>Humidity</b>	5-95% RH
<b>Remote Sense</b>	10% of Vout nominal ( Note 7 )	<b>EMC</b>	EN55011, EN55022 Class A ( see note 9 )
<b>Ripple &amp; noise</b>	See table. 20MHZ bandwidth	<b>ESD</b>	EN61000-4-2
<b>Temp. Coefficient</b>	±0.02% / °C	<b>Radiated Immunity</b>	EN61000-4-3
<b>Transient Response</b>	250uS ( 25% load step change )	<b>Fast Transients</b>	EN61000-4-4
<b>Over Voltage Protection</b>	Set at 110 ~130% of Voltage output nominal	<b>Surge</b>	EN61000-4-5
<b>Overload Protection</b>	Set at 120 ~ 150% of output load	<b>Conducted Immunity</b>	EN61000-4-6
<b>Short Circuit protection</b>	Continuous hiccup mode, auto recovery.		

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Model Number	Input Range	Output Voltage	Output Current		Line Regulation	Load Regulation	Output <sup>(3)(4)</sup> Ripple & Noise	Input <sup>(2)</sup> No Load Current	Eff <sup>(3)</sup> (%)
			Min. load	Full load					
HAE200-24S3P3WP	9 – 36 V	3.3 VDC	0mA	50 A	7mV	10mV	75mVp-p	50mA	87
HAE200-24S05WP	9 – 36 V	5 VDC	0mA	36 A	10mV	15mV	75mVp-p	50mA	90
HAE200-24S12WP	8.5 – 36 V	12 VDC	0mA	15 A	24mV	30mV	100mVp-p	50mA	89
HAE200-24S15WP	8.5 – 36 V	15 VDC	0mA	12 A	30mV	38mV	100mVp-p	50mA	90
HAE200-24S24WP	8.5 – 36 V	24 VDC	0mA	7.5 A	48mV	48mV	200mVp-p	50mA	90
HAE200-24S28WP	8.5 – 36 V	28 VDC	0mA	6.5 A	56mV	56mV	200mVp-p	50mA	90
HAE200-24S48WP	8.5 – 36 V	48 VDC	0mA	3.7 A	96mV	72mV	300mVp-p	50mA	89
HAE200-48S3P3WP	16.5 – 75 V	3.3 VDC	0mA	50 A	7mV	10mV	75mVp-p	25mA	88
HAE200-48S05WP	16.5 – 75 V	5 VDC	0mA	40 A	10mV	15mV	75mVp-p	25mA	91
HAE200-48S12WP	16.5 – 75 V	12 VDC	0mA	18 A	24mV	30mV	100mVp-p	25mA	90
HAE200-48S15WP	16.5 – 75 V	15 VDC	0mA	14 A	30mV	38mV	100mVp-p	25mA	91
HAE200-48S24WP	16.5 – 75 V	24 VDC	0mA	9A	48mV	48mV	200mVp-p	25mA	90
HAE200-48S28WP	16.5 – 75 V	28 VDC	0mA	7.5 A	56mV	56mV	200mVp-p	25mA	91
HAE200-48S48WP	16.5 – 75 V	48 VDC	0mA	4.5 A	96mV	72mV	300mVp-p	25mA	90
HAE200-110S3P3WP	43 – 160 V	3.3 VDC	0mA	57 A	7mV	10mV	75mVp-p	15mA	87
HAE200-110S05WP	43 – 160 V	5 VDC	0mA	44 A	10mV	15mV	75mVp-p	15mA	89
HAE200-110S12WP	43 – 160 V	12 VDC	0mA	20 A	24mV	30mV	100mVp-p	15mA	89
HAE200-110S15WP	43 – 160 V	15 VDC	0mA	16 A	30mV	38mV	100mVp-p	15mA	90
HAE200-110S24WP	43 – 160 V	24 VDC	0mA	10A	48mV	48mV	200mVp-p	15mA	89
HAE200-110S28WP	43 – 160 V	28 VDC	0mA	8.5 A	56mV	56mV	200mVp-p	15mA	90
HAE200-110S48WP	43 – 160 V	48 VDC	0mA	5 A	96mV	72mV	300mVp-p	15mA	89

- **P suffix models are supplied with Positive Logic, PCB Mounting.**
- **PT suffix models are supplied with Positive Logic & Terminal Block assembly.**

**Notes:**

1. BELLCORE TR-NWT-000332. Case 1: 50% Stress, Temperature at 40 °C. MIL-HDBK-217F Notice2 @Ta=25 °C, Full load(Ground, Benign, controlled environment).
2. Typical value at nominal input voltage and no load.
3. Typical value at nominal input voltage and full load.
4. The ripple and noise of output voltage 24V/ 28V is measured with a 4.7µF/50V X7R MLCC; The ripple and noise of output voltage 48V is measured with a 2.2µF/100V X7R MLCC; The ripple and noise of other output voltage is measured with a 1µF/25V X7R MLCC and a 22µF/25V POS-CAP.
5. The remote ON/OFF control pin voltage is referenced to –Vin. The positive logic is optional. To order positive logic ON-OFF control add the suffix -P (Ex: HAE200-48S05W-P).
6. Output voltage is adjustable for 10% trim up or -20% trim down of nominal output voltage by connecting a single resistor between TRIM and +SENSE pins for trim up or between TRIM and –SENSE pins for trim down. To calculate the value of the resistor Ru and Rd for a particular output voltage uses the following equation:

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

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

7. Maximum output deviation is +10% inclusive of remote sense and trim. If remote sense is not being used, the +SENSE should be connected to its corresponding +OUTPUT and likewise the -SENSE should be connected to its corresponding –OUTPUT.
8. (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.
9. The HAE200W series standard module meets EN55011 and EN55022 Class A or Class B only with external components. For more detail information, please contact with P-DUKE.
10. An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. The HAE200-24SXXW and HAE200-48SXXW recommended 2 piece of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220µF/100V, ESR 48mΩ) to connect in parallel. The HAE200-110SXXW recommended 3 piece of aluminum electrolytic capacitor (Ruby-con BXF series, 100µF/250V) to connect in parallel.
11. CASE GROUNDING: When you connect the case pin and the four screw bolts to shield plane, the EMI could be reduced.
12. Input source impedance: The power modules 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 HAE200-24SXXW and HAE200-48SXXW recommended Nippon Chemi-con KY series, 100µF/100V, ESR 110mΩ. The HAE200-110SXXW recommended Ruby-con BXF series, 68µF/200V.
13. (1)Multiple HAE200W 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 application note.

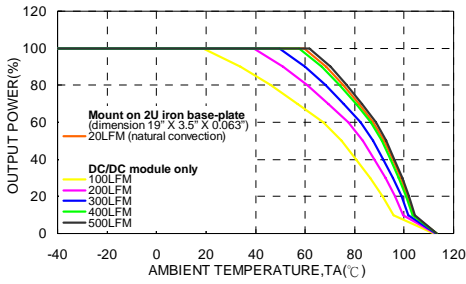
**CAUTION:** This power module is not internally fused. An input line fuse must always be used.

# HAE200W SERIES

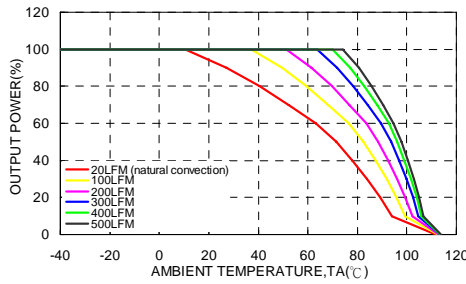
DC / DC Single Output: 200 Watts



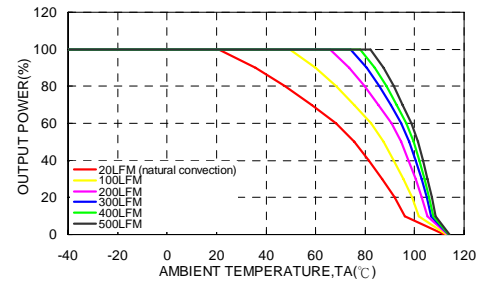
HAE200-48S05W Derating Curve (Note 8)



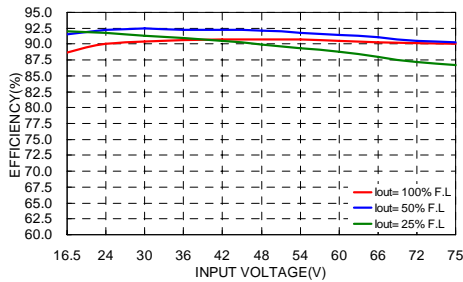
HAE200-48S05W Derating Curve (Note 8) With 0.24" Height Heat-sink



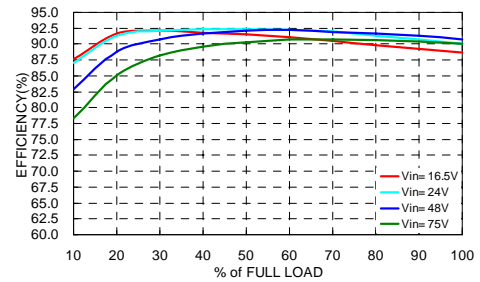
HAE200-48S05W Derating Curve (Note 8) With 0.45" Height Heat-sink



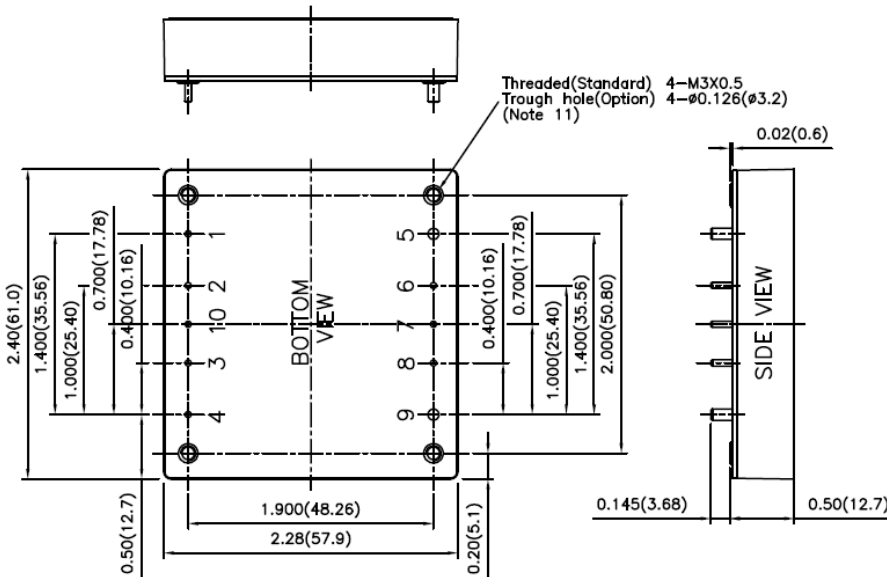
HAE200-48S05W Efficiency VS Input Voltage



HAE200-48S05W Efficiency VS Output Load



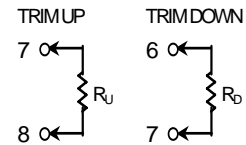
## Metal case mechanical drawing



- All dimensions in inches (mm)
- Tolerance :x.xx±0.02 (x.x±0.5)  
x.xxx±0.01 (x.xx±0.25)
- Pin pitch tolerance ±0.01 (0.25)
- Pin dimension tolerance ±0.004(0.1)

### EXTERNAL OUTPUT TRIMMING

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



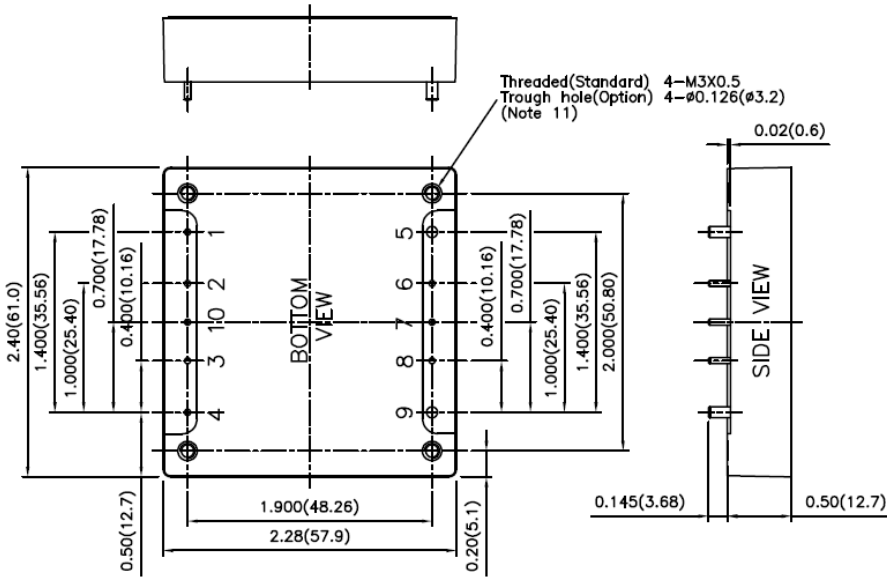
### PIN CONNECTION

PIN	Define	Diameter
1	- INPUT	0.04 Inches
2	CASE (option)	0.04 Inches
3	CTRL	0.04 Inches
4	+ INPUT	0.04 Inches
5	- OUTPUT	0.08 Inches
6	- SENSE	0.04 Inches
7	TRIM	0.04 Inches
8	+ SENSE	0.04 Inches
9	+ OUTPUT	0.08 Inches
10	Sync (option)	0.04 Inches

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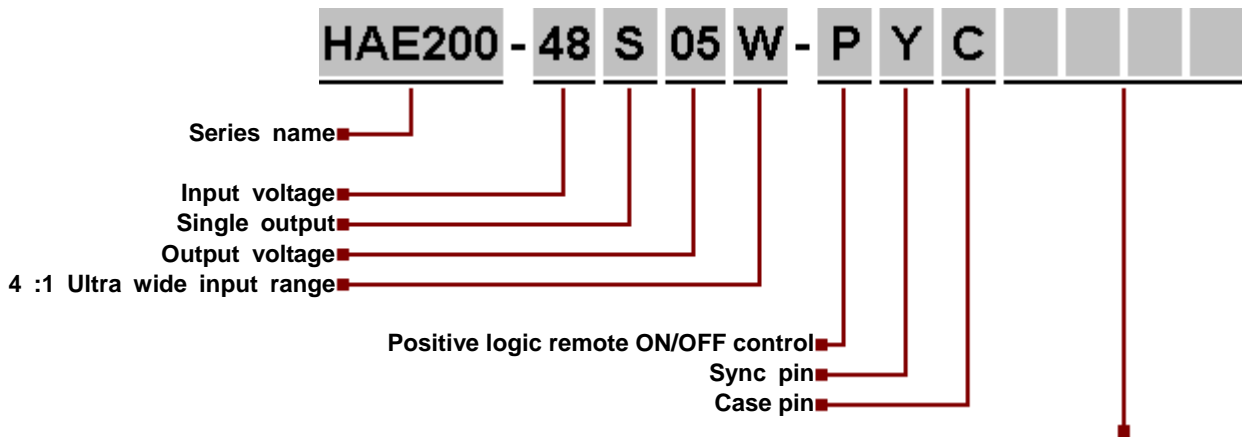
## Plastic case mechanical drawing



PIN CONNECTION		
PIN	Define	Diameter
1	- INPUT	0.04 Inches
2	CASE (option)	0.04 Inches
3	CTRL	0.04 Inches
4	+ INPUT	0.04 Inches
5	- OUTPUT	0.08 Inches
6	- SENSE	0.04 Inches
7	TRIM	0.04 Inches
8	+ SENSE	0.04 Inches
9	+ OUTPUT	0.08 Inches
10	Sync (option)	0.04 Inches

1. All dimensions in inches (mm)
2. Tolerance :x.xx±0.02 (x.xx±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)

## Part number structure



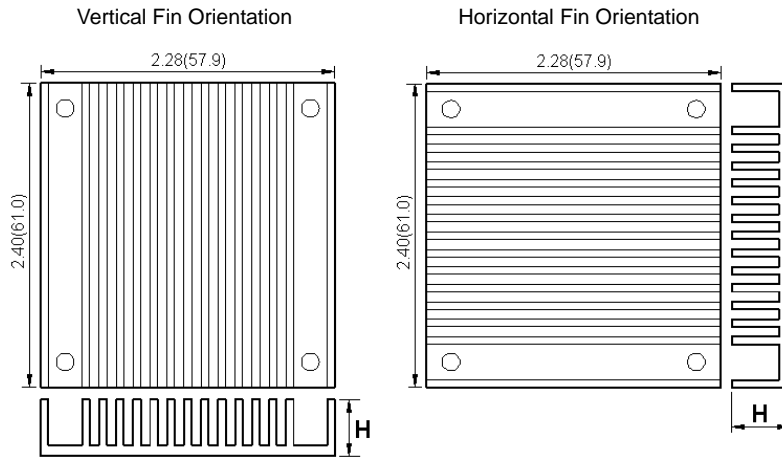
Heat-sink mounting hole model : Through hole (No thread)		TH
H= 0.45" Heat-sink	Vertical	: 7G-0021A-F HS
	Horizontal	: 7G-0024A-F HS3
H= 0.24" Heat-sink	Vertical	: 7G-0023A-F HS2
	Horizontal	: 7G-0022A-F HS1
Terminal block*	---	T
	Include Din Rail Clip	TDR
Terminal block with EMC filter* (EN55011, EN55022 Class A)	---	TF
	Include Din Rail Clip	TFDR

Note: No Y and C function for terminal block type.

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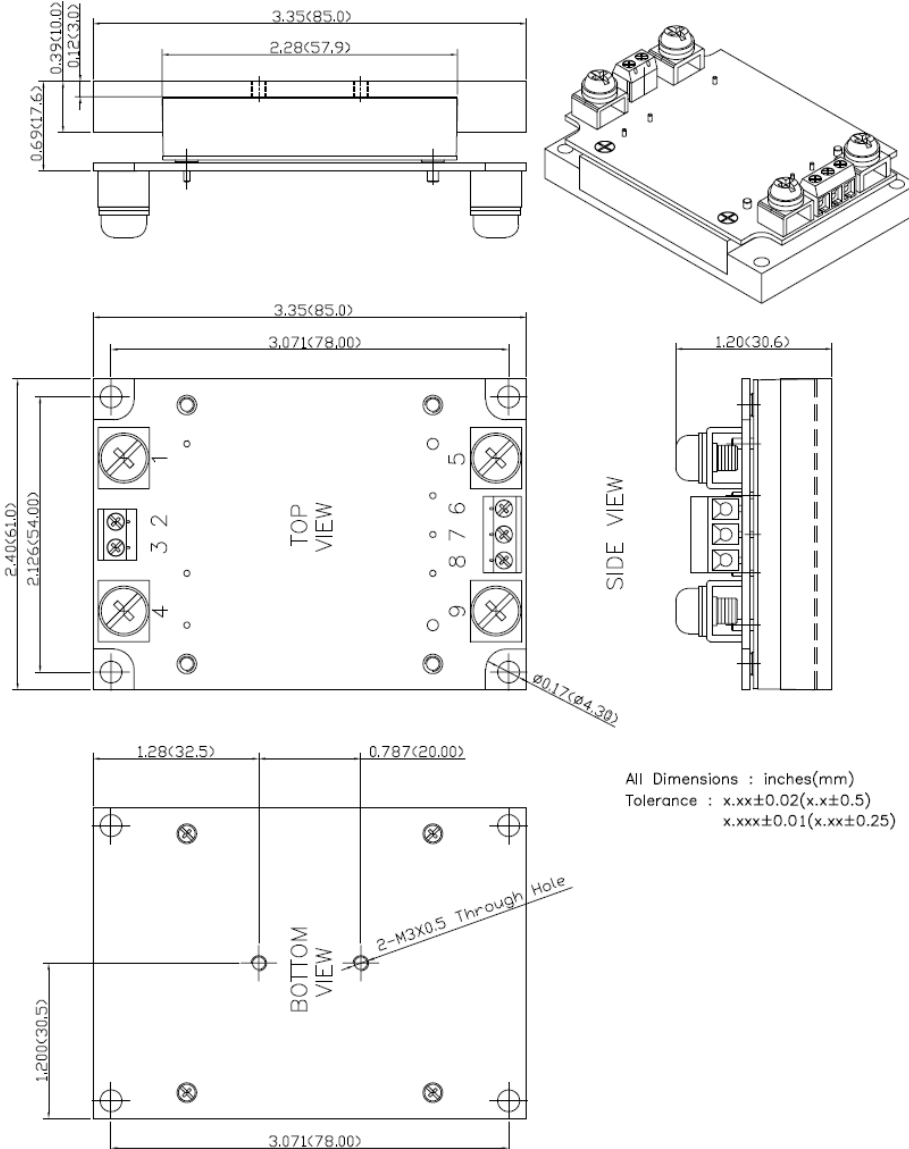
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## Heat-sink type (Suffix -HS)



## Terminal block type mechanical drawing

### 1) Terminal Block without EMC Filter, Suffix: -T



All Dimensions : inches(mm)  
Tolerance : x.xx±0.02(x.x±0.5)  
x.xxx±0.01(x.xx±0.25)

**EXTERNAL OUTPUT TRIMMING**  
Output can be externally trimmed by using the method shown below.

TRIM UP

TRIM DOWN

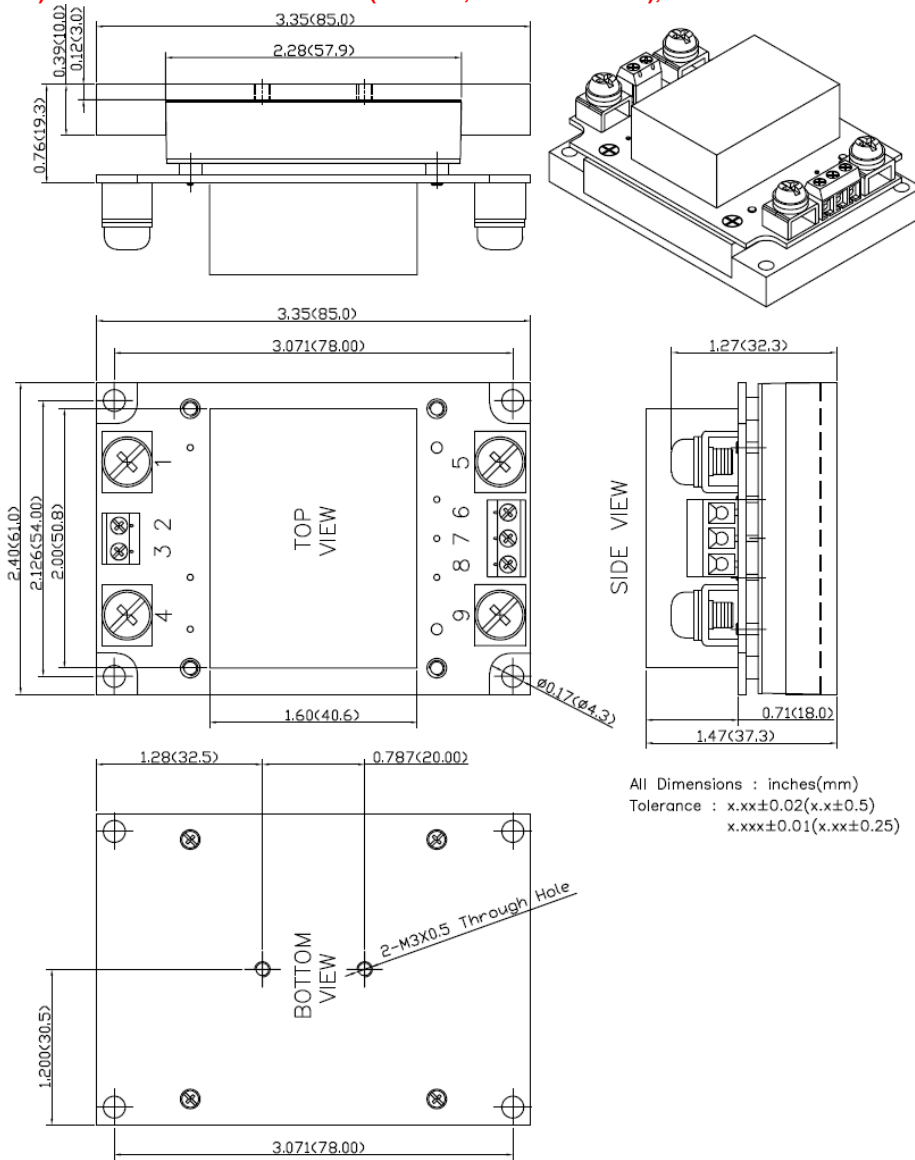
TERMINAL CONNECTION		
Terminal	Define	wire range
1	- INPUT	8 AWG to 9 AWG
2	NC	NA
3	CTRL	14 AWG to 18 AWG
4	+ INPUT	14 AWG to 18 AWG
5	- OUTPUT	4 AWG to 5 AWG
6	- SENSE	14 AWG to 18 AWG
7	TRIM	14 AWG to 18 AWG
8	+ SENSE	14 AWG to 18 AWG
9	+ OUTPUT	4 AWG to 5 AWG

Note: These two M3x0.5 through holes are designed for Din Rail Clip assembly. The depth of heat sink is allowed to be screwed into 2.8mm maximum. Customer shall take care as select the screw to avoid damaging the converter.

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## 2) Terminal Block with EMC Filter (EN55011, EN55022 Class A), Suffix: -TF



TERMINAL CONNECTION		
Terminal	Define	wire range
1	- INPUT	8 AWG to 9 AWG
2	NC	NA
3	CTRL	14 AWG to 18 AWG
4	+ INPUT	14 AWG to 18 AWG
5	- OUTPUT	4 AWG to 5 AWG
6	- SENSE	14 AWG to 18 AWG
7	TRIM	14 AWG to 18 AWG
8	+ SENSE	14 AWG to 18 AWG
9	+ OUTPUT	4 AWG to 5 AWG

Note: These two M3x0.5 through holes are designed for Din Rail Clip assembly. The depth of heat sink is allowed to be screwed into 2.8mm maximum. Customer shall take care as select the screw to avoid damaging the converter.

## 3) Terminal Block with Din Rail Clip (Suffix -TDR, -TFDR)

