



FEATURES

- OUTPUT POWER RANGE UP TO 240 WATTS
- 4:1 ULTRA WIDE INPUT VOLTAGE RANGE
- HIGH EFFICIENCY UP TO 91%
- NO MINIMUM LOAD REQUIRED
- SOFT-START
- INDUSTRY STANDARD HALF-BRICK FOOTPRINT
- SIX-SIDED CONTINUOUS SHIELD FOR 24V_{IN} AND 48 V_{IN} MODULE
- INPUT TO OUTPUT BASIC INSULATION: 2250 VDC
- RAILWAY APPLICATION
- UL60950-1, EN60950-1, IEC60950-1 AND EN50155 SAFETY APPROVALS PENDING
- COMPLIANT TO RoHS EU DIRECTIVE 2002/95/EC

APPLICATIONS

- Wireless Network
- Telecom/Datacom
- Industry Control System
- Distributed Power Architectures
- Semiconductor Equipment
- Railway System

OPTIONS

- Positive logic remote ON/OFF
- Synchronous
- Case pin
- Heat-sink
- Terminal block
- Terminal block with EMC filter (EN55011, EN55022 Class A)
- Terminal block with Din Rail Clip

DESCRIPTION

The HAE200W series DC/DC converters provide up to 240 watts of output power in an industry standard half-brick package and footprint. All models feature a ultra wide input range, adjustable output voltage.

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

OUTPUT SPECIFICATIONS			
Output power range	165 ~ 240 Watts		
Voltage accuracy	±1%		
Voltage adjustability (Note 7)	+10%, -20%		
Minimum load	0%		
Line regulation	LL to HL at Full Load	±0.1%	
Load regulation	No Load to Full Load	±0.1%	
Remote sense (Note 8)	10% of Vout(nom)		
Ripple and noise	20MHz bandwidth	See table	
Temperature coefficient	±0.02%/°C, max.		
Transient response recovery time	25% load step change	250µS	
Over voltage protection threshold	Hiccup	115% ~ 130% of Vout(nom)	
Over current protection threshold	120% ~ 150% of Iout Rated		
Short circuit protection	Hiccup, automatics recovery		
INPUT SPECIFICATIONS			
Input voltage range	24VDC nominal input	3.3 & 5Vout	9 ~ 36VDC
		Others	8.5 ~ 36VDC
	48VDC nominal input		16.5 ~ 75VDC
Start-up voltage	24VDC input	9VDC, max.	
	48VDC input	18VDC, max.	
Shutdown voltage	24VDC input	7.3 ~ 8.1VDC	
	48VDC input	15.5 ~ 16.3VDC	
Input filter (Note 13)	110VDC nominal input	43 ~ 160VDC	
		Pi type	
Input surge voltage 1S, max.	24VDC input	50VDC 1sec, max.	
	48VDC input	100VDC 1sec, max.	
	110VDC input	185VDC 1sec, max.	
Start up time	Nominal input and constant resistive load	Power up	75mS
		Remote ON/OFF	75mS
Sync pin signal (Note 14)	-0.3V ~ 5.6V		
Remote ON/OFF (Note 6) (Negative logic) (Standard)	DC-DC ON	Short or 0V < Vr < 1.2V	
	DC-DC OFF	Open or 3V < Vr < 12V	
(Positive logic) (Option)	DC-DC ON	Open or 3V < Vr < 12V	
	DC-DC OFF	Short or 0V < Vr < 1.2V	
Input current of remote control pin	Nominal input	-0.5mA ~ 1mA	
Remote off state input current	Nominal input	3mA	

GENERAL SPECIFICATIONS			
Efficiency	See table		
Isolation voltage	Input to Output (Basic insulation)	2250VDC, min. 1minute	
	Input (Output) to Case	1600VDC, min. 1minute	
Isolation resistance	10 ⁹ ohms, min.		
Isolation capacitance	2500pF, max.		
Switching frequency	250KHz±10%		
Safety approvals pending	IEC60950-1, UL60950-1, EN60950-1, EN50155		
Case material	24 & 48VDC input	Metal	
	110VDC input	Aluminum base-plate with plastic case	
Base material	24 & 48VDC input	FR4 PCB	
Potting material	Silicon (UL94-V0)		
Dimensions	2.40 X 2.28 X 0.50 Inch (61.0x57.9x12.7 mm)		
Weight	105g (3.70oz)		
MTBF (Note 1)	BELLCORE TR-NWT-000332	1.010 x 10 ⁶ hrs	
	MIL-HDBK-217F	7.416 x 10 ⁴ hrs	
ENVIRONMENTAL SPECIFICATIONS			
Operating Case temperature range	Base-plate	-40°C ~ +115°C	
Over temperature protection	+120°C		
Storage temperature range	-55°C ~ +125°C		
Thermal impedance (Note 9)	without Heat-sink	6.1°C/Watt	
	with 0.24" Height Heat-sink	5.1°C/Watt	
	with 0.45" Height Heat-sink	4.6°C/Watt	
	Only mount on the iron base-plate	2.8°C/Watt	
Thermal shock	EN61373, MIL-STD-810F		
Vibration	EN61373, MIL-STD-810F		
Relative humidity	5% to 95% RH		
EMC CHARACTERISTICS			
EMI Standard (Note 10)	EN55011, EN55022	Class A	
	Option TF or TFDR EN55011, EN55022	Class A	
ESD	EN61000-4-2	Air	± 8KV
		Contact	± 6KV
Radiated immunity	EN61000-4-3	20 V/m Perf. Criteria A	
Fast transient (Note 11)	EN61000-4-4	± 2KV Perf. Criteria A	
Surge (Note 11)	EN61000-4-5	± 2KV Perf. Criteria A	
Conducted immunity	EN61000-4-6	10 ¹⁰ Perf. Criteria A	
		Vr.m.s	





Model Number	Input Range	Output Voltage	Output Current		Output ^{(3) (4)} Ripple & Noise	No Load ⁽²⁾ Input Current	Eff ⁽³⁾ (%)	Capacitor ⁽⁵⁾ Load max.
			Min. load	Full load				
HAE200-24S3P3W	9 ~ 36 VDC	3.3 VDC	0mA	50 A	75mVp-p	25mA	87	151000μF
HAE200-24S05W	9 ~ 36 VDC	5 VDC	0mA	36 A	75mVp-p	30mA	90	72000μF
HAE200-24S12W	8.5 ~ 36 VDC	12 VDC	0mA	15 A	100mVp-p	30mA	89	12500μF
HAE200-24S15W	8.5 ~ 36 VDC	15 VDC	0mA	12 A	100mVp-p	30mA	90	8000μF
HAE200-24S24W	8.5 ~ 36 VDC	24 VDC	0mA	7.5 A	200mVp-p	35mA	90	3100μF
HAE200-24S28W	8.5 ~ 36 VDC	28 VDC	0mA	6.5 A	200mVp-p	40mA	90	2300μF
HAE200-24S48W	8.5 ~ 36 VDC	48 VDC	0mA	3.7 A	300mVp-p	45mA	89	770μF
HAE200-48S3P3W	16.5 ~ 75 VDC	3.3 VDC	0mA	50 A	75mVp-p	20mA	88	151000μF
HAE200-48S05W	16.5 ~ 75 VDC	5 VDC	0mA	40 A	75mVp-p	20mA	91	80000μF
HAE200-48S12W	16.5 ~ 75 VDC	12 VDC	0mA	18 A	100mVp-p	20mA	90	15000μF
HAE200-48S15W	16.5 ~ 75 VDC	15 VDC	0mA	14 A	100mVp-p	20mA	91	9300μF
HAE200-48S24W	16.5 ~ 75 VDC	24 VDC	0mA	9A	200mVp-p	20mA	90	3700μF
HAE200-48S28W	16.5 ~ 75 VDC	28 VDC	0mA	7.5 A	200mVp-p	25mA	91	2600μF
HAE200-48S48W	16.5 ~ 75 VDC	48 VDC	0mA	4.5 A	300mVp-p	25mA	90	930μF
HAE200-110S3P3W	43 ~ 160 VDC	3.3 VDC	0mA	57 A	75mVp-p	10mA	87	172000μF
HAE200-110S05W	43 ~ 160 VDC	5 VDC	0mA	44 A	75mVp-p	10mA	89	88000μF
HAE200-110S12W	43 ~ 160 VDC	12 VDC	0mA	20 A	100mVp-p	10mA	89	16600μF
HAE200-110S15W	43 ~ 160 VDC	15 VDC	0mA	16 A	100mVp-p	10mA	90	10600μF
HAE200-110S24W	43 ~ 160 VDC	24 VDC	0mA	10A	200mVp-p	10mA	89	4100μF
HAE200-110S28W	43 ~ 160 VDC	28 VDC	0mA	8.5 A	200mVp-p	15mA	90	3000μF
HAE200-110S48W	43 ~ 160 VDC	48 VDC	0mA	5 A	300mVp-p	15mA	89	1000μF

Note

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 and no load.
3. Typical value at nominal input and full load.
4. The ripple and noise of output voltage 24VDC/ 28VDC is measured with a 4.7μF/50V X7R 1812 MLCC,
The ripple and noise of output voltage 48VDC is measured with a 2.2μF/100V X7R 1812 MLCC,
The ripple and noise of other output voltage is measured with a 1μF/25V X7R MLCC and a 22μF/25V D-type POS-CAP.
5. Test by minimum input and constant resistive load.
6. The CTRL pin voltage is referenced to -INPUT. The positive logic is optional.
To order positive logic ON-OFF control add the suffix -P (Ex: HAE200-48S05W-P).
7. 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:

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

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

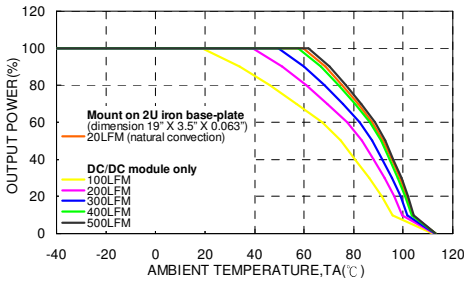
8. Maximum output deviation is +10% inclusive of remote sense and trim. If remote sense is not being used, the +SENSE should be connected to its corresponding +OUTPUT and likewise the -SENSE should be connected to its corresponding -OUTPUT.
9. (1)Thermal test condition with vertical direction by natural 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.
10. 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.
11. 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 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V, ESR 48mΩ) to connect in parallel.
The HAE200-110SXXW recommended 3 pcs of aluminum electrolytic capacitor (Ruby-con BXF series, 100μF/250V) to connect in parallel.
12. CASE GROUNDING: When connect four screw bolts to shield plane, the EMI could be reduced.
13. 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.
14. (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.

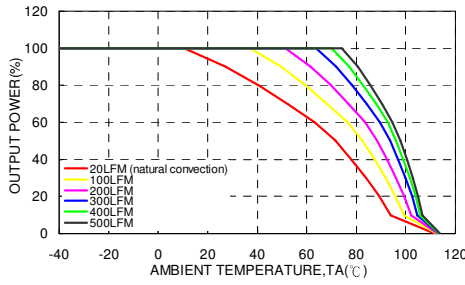




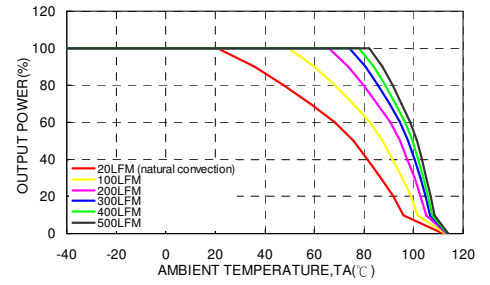
HAE200-48S05W Derating Curve (Note 9)



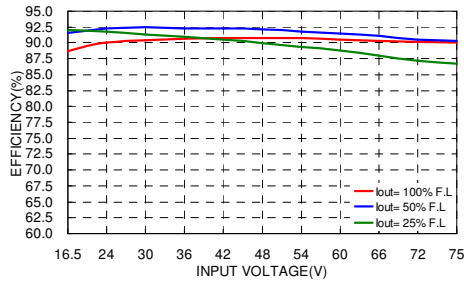
HAE200-48S05W Derating Curve (Note 9) With 0.24" Height Heat-sink



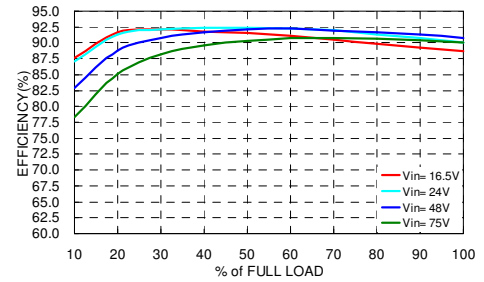
HAE200-48S05W Derating Curve (Note 9) With 0.45" Height Heat-sink



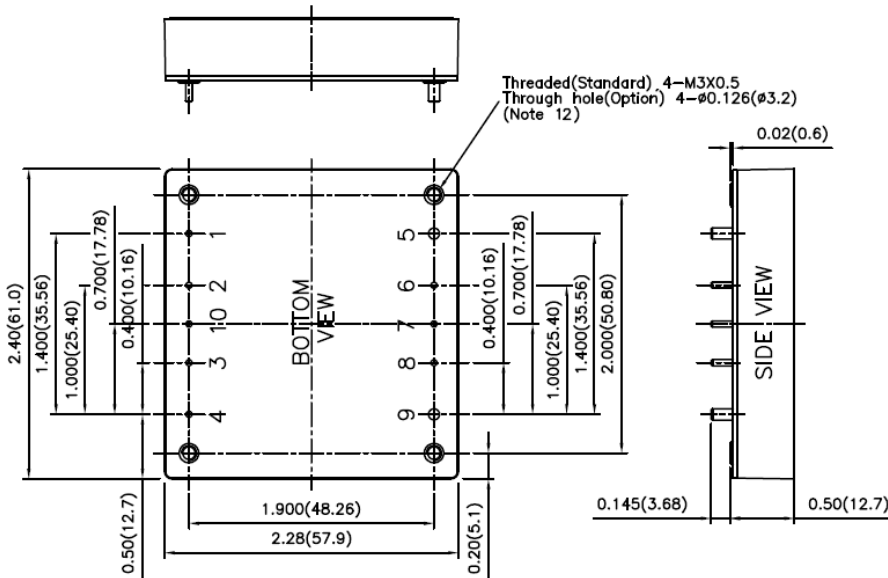
HAE200-48S05W Efficiency VS Input Voltage



HAE200-48S05W Efficiency VS Output Load

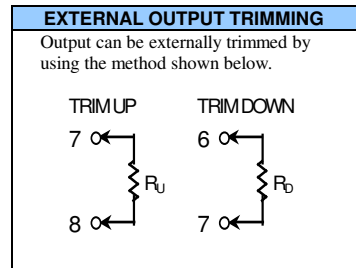


Metal case mechanical drawing:



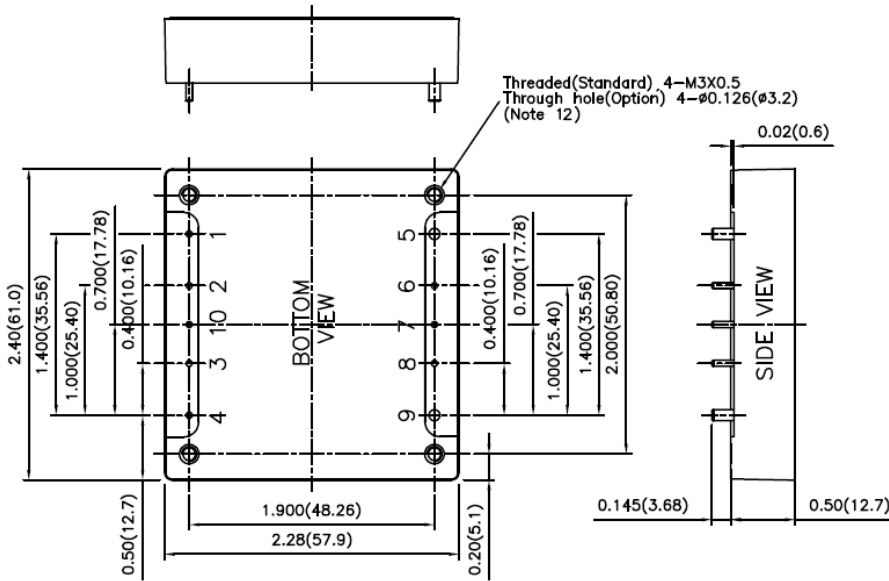
1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)
x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)

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





Plastic case 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)

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

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

TRIM UP

TRIM DOWN

Part number structure:

<u>HAE</u>	<u>200</u>	-	<u>48</u>	<u>S</u>	<u>05</u>	<u>W</u>	-	<u>P</u>	<u>Y</u>	<u>C</u>	<u>HS</u>
SERIES NAME	Output Power		Input Voltage	Output Quantity	Output Voltage	4:1 Input Range		Remote ON/OFF Options	Sync pin Options	Case pin Options	Heat-Sink Mounting Options
	200Watts		24: 8.5~36VDC 9~36VDC 48: 16.5~75VDC 110: 43~160VDC	S: Single	3P3: 3.3VDC 05: 5VDC 12: 12VDC 15: 15VDC 24: 24VDC 28: 28VDC 48: 48VDC			P: Positive	Y: Sync pin	C: Case pin	TH: Through hole type.(no thread) ⁽¹⁾ HS: H=0.45" Vertical, 7G-0021A-F HS1: H=0.24" Horizontal, 7G-0022A-F HS2: H=0.24" Vertical, 7G-0023A-F HS3: H=0.45" Horizontal, 7G-0024A-F T: Terminal block ⁽²⁾ TDR: Terminal block with Din Rail Clip ⁽²⁾ TF: Terminal block with EMC filter ^{(2) (3)} TFDR: Terminal block with EMC filter and Din Rail Clip ^{(2) (3)}

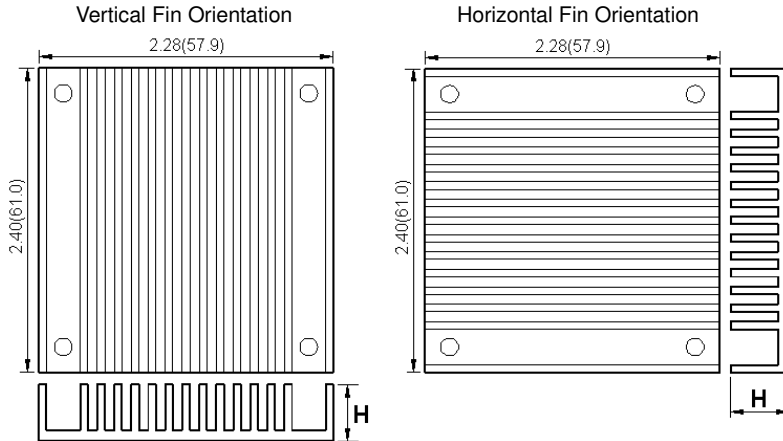
⁽¹⁾ The module can't equip Heat-sink with TH option.
⁽²⁾ No Y and C function for terminal block type.
⁽³⁾ EMI filter meet EN55011, EN55022 Class A.





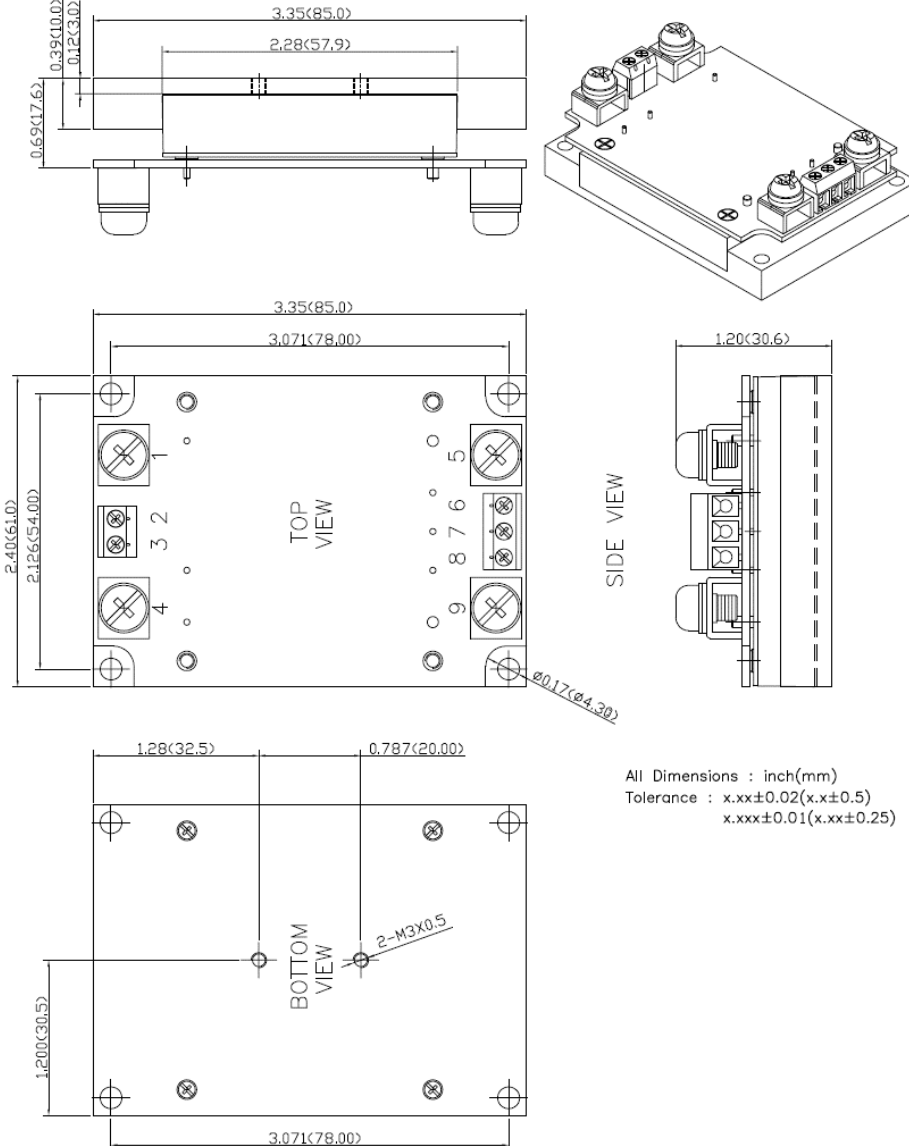
Heat-sink type:

Suffix: -HS, -HS1, -HS2, -HS3



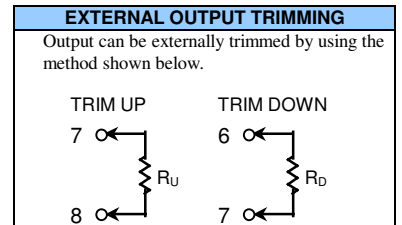
Terminal block type mechanical drawing:

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



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

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 M3×0.5 threaded 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.



ERROR: stackunderflow
OFFENDING COMMAND: ~

STACK: