

HAE150W SERIES

DC / DC Single Output: 150 Watts



PCB Model

Terminal Block Model

Specifications:

Input Voltage	24VDC (9 ~ 36), 48VDC (16.5 ~ 75) 110VDC (43~160)
Input Filter	Pi type (see note 13)
Start-up Voltage	24V input: 9V typ, 48V input: 18V typ. 110V input: 43V
Shutdown Voltage	24V input: 7.3~8V, 48V input: 15.5~16.3V 110V input: 33~36V
Input Surge Voltage.	24V: 50VDC. 48V: 100VDC (1 sec max) 110V: 185VDC (1 sec max)
Input Reverse Voltage Protection	External input fuse required
Start Up time	Typically 75mS constant resistive load
Sync Pin	-0.3~5.6V (see note 14)
Remote ON/OFF note 6 Negative Logic	DC-DC ON Short or $0V < V_r < 1.2V$ DC-DC OFF Open or $3.0V < V_r < 12V$
(Positive Logic -P)	DC-DC ON Open or $3.0V < V_r < 12V$ DC-DC OFF Short or $0V < V_r < 1.2V$
	Input current of remote control pin: 0.5~1mA. Remote off state input current: 3mA
Output power	130~ 180 watts
Voltage Accuracy	±1.0%
Voltage Trim	+10% to -20% External voltage trim
Minim Load	Zero
Line Regulation	±0.1%
Load Regulation	±0.1%
Remote Sense	10% of V_{out} nominal (Note 8)
Ripple & noise	See table. 20MHZ bandwidth
Temp. Coefficient	±0.02% / °C
Transient Response	250uS (25% load step change)
Over Voltage Protection	Set at 110 ~130% of Voltage output
Overload Protection	Set at 120 ~ 150% of output load
Short Circuit protection	Continuous hiccup mode, auto recovery.

Features

- 4:1 wide Input range option 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
- Six sided continuous copper shield (24/48V input)
- 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)

Efficiency	Model dependant 86 ~ 91%
Isolation	Input – Output: 2250VDC Input / Output – Case: 1600VDC
Isolation Cap.	2500pF
Switching Freq.	250KHz
Safety	EN60950-1, UL60950-1, EN50155 (pending)
Case Material	24 & 48V input – Metal Case 110V input - Aluminium base with plastic case
Base Material	FR4 PCB (24 & 48V)
Potting	Epoxy UL94-V0
Dimensions	61 X 57.9 X 12.7mm
Weight	105g
MTBF	7.416 x 104Hrs (MIL-HDBK-217F)
Operating Base Plate Temperature	-40°C to +115°C maximum base temperature
Over Temp. Protection	Shutdown approx 120°C base temperature
Thermal Impedance	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
Thermal shock	MIL-STD-810F & EN61373
Vibration	MIL-STD-810F & EN61373
Humidity	5-95% RH
EMC	EN55011, EN55022 Class A (see note 10)
ESD	EN61000-4-2 ±8KV Air ±6KV Contact
Radiated Immunity	EN61000-4-3
Fast Transients	EN61000-4-4
Surge	EN61000-4-5
Conducted Immunity	EN61000-4-6

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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				
HAE150-24S3P3WP	9 ~ 36 V	3.3 V	0mA	40 A	75mVp-p	20mA	88	121000μF
HAE150-24S05WP	9 ~ 36 V	5 V	0mA	28 A	75mVp-p	25mA	90	56000μF
HAE150-24S12WP	8.5 ~ 36 V	12 V	0mA	12 A	100mVp-p	25mA	90	10000μF
HAE150-24S15WP	8.5 ~ 36 V	15 V	0mA	9.5 A	100mVp-p	25mA	91	6300μF
HAE150-24S24WP	8.5 ~ 36 V	24 V	0mA	6A	200mVp-p	25mA	90	2500μF
HAE150-24S28WP	8.5 ~ 36 V	28 V	0mA	5 A	200mVp-p	25mA	90	1700μF
HAE150-24S48WP	8.5 ~ 36 V	48 V	0mA	3 A	300mVp-p	25mA	90	620μF
HAE150-48S3P3WP	16.5 ~ 75 V	3.3 V	0mA	40 A	75mVp-p	15mA	89	121000μF
HAE150-48S05WP	16.5 ~ 75 V	5 V	0mA	30 A	75mVp-p	15mA	91	60000μF
HAE150-48S12WP	16.5 ~ 75 V	12 V	0mA	13 A	100mVp-p	20mA	91	10800μF
HAE150-48S15WP	16.5 ~ 75 V	15 V	0mA	10 A	100mVp-p	20mA	91	6600μF
HAE150-48S24WP	16.5 ~ 75 V	24 V	0mA	6.5A	200mVp-p	20mA	91	2700μF
HAE150-48S28WP	16.5 ~ 75 V	28 V	0mA	5.5 A	200mVp-p	20mA	91	1900μF
HAE150-48S48WP	16.5 ~ 75 V	48 V	0mA	3.2 A	300mVp-p	25mA	91	660μF
HAE150-110S3P3WP	43 ~ 160 V	3.3 V	0mA	43 A	75mVp-p	10mA	88	130000μF
HAE150-110S05WP	43 ~ 160 V	5 V	0mA	32 A	75mVp-p	10mA	90	64000μF
HAE150-110S12WP	43 ~ 160 V	12 V	0mA	15 A	100mVp-p	10mA	90	12500μF
HAE150-110S15WP	43 ~ 160 V	15 V	0mA	12 A	100mVp-p	10mA	90	8000μF
HAE150-110S24WP	43 ~ 160 V	24 V	0mA	7.5 A	200mVp-p	10mA	90	3100μF
HAE150-110S28WP	43 ~ 160 V	28 V	0mA	6.5 A	200mVp-p	10mA	90	2300μF
HAE150-110S48WP	43 ~ 160 V	48 V	0mA	3.8 A	300mVp-p	10mA	90	790μF

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

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 1206 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: HAE150-48S05W-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:

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

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

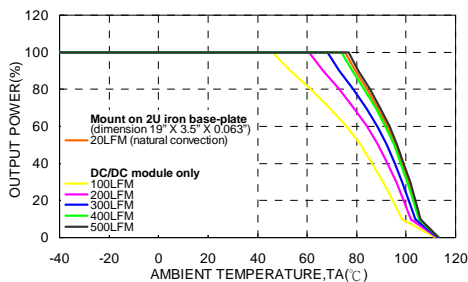
8. Maximum output deviation is +10% inclusive of remote sense and trim. If remote sense is not being used, the +SENSE should be connected to its corresponding +OUTPUT and likewise the -SENSE should be connected to its corresponding -OUTPUT.
9. (1)Thermal test condition with vertical direction by natural 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 HAE150W 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 HAE150-24SXXW and HAE150-48SXXW recommended 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V, ESR 48mΩ) to connect in parallel. The HAE150-110SXXW 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 HAE150-24SXXW and HAE150-48SXXW recommended Nippon Chemi-con KY series, 100μF/100V, ESR 110mΩ. The HAE150-110SXXW recommended Ruby-con BXF series, 68μF/200V.
14. (1)Multiple HAE150W 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.

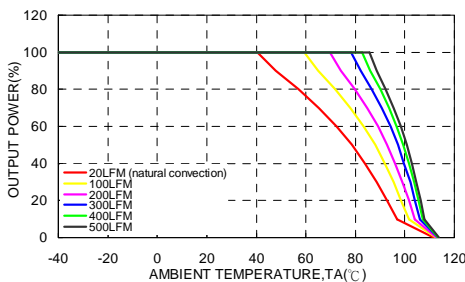
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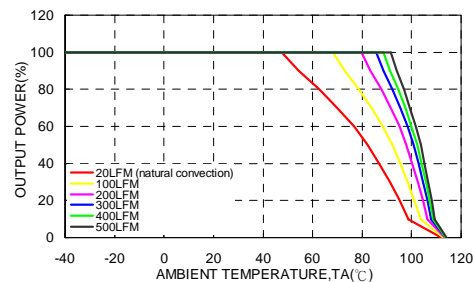
HAE150-48S05W Derating Curve (Note 9)



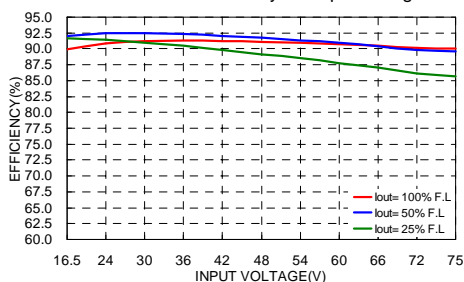
HAE150-48S05W Derating Curve (Note 9) With 0.24" Height Heat-sink



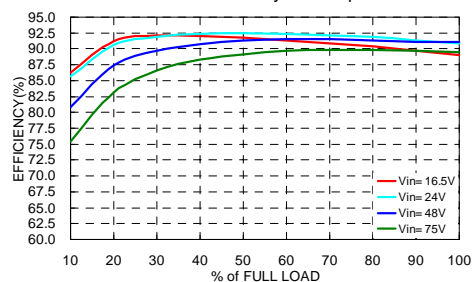
HAE150-48S05W Derating Curve (Note 9) With 0.45" Height Heat-sink



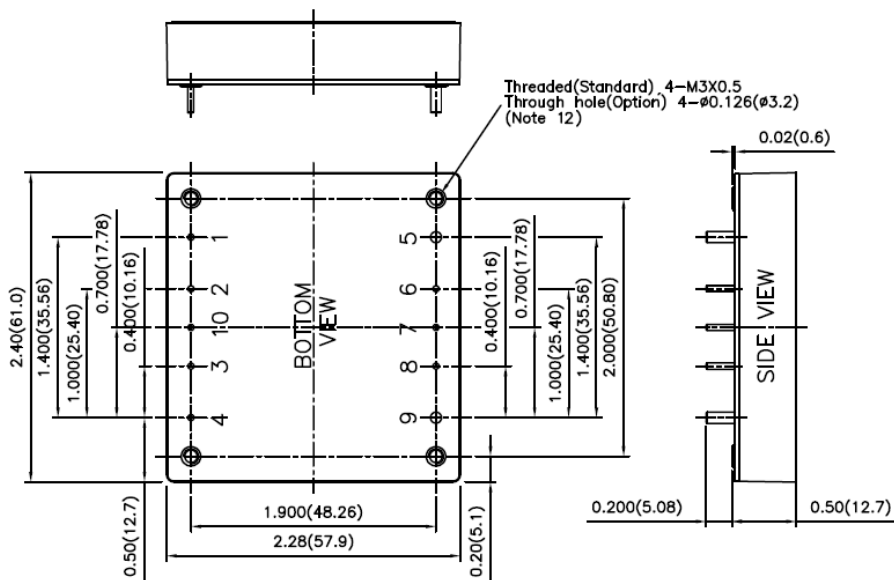
HAE150-48S05W Efficiency VS Input Voltage



HAE150-48S05W Efficiency VS Output Load



Metal case mechanical drawing: (24V & 48V input)

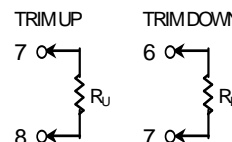


1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)
x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)

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

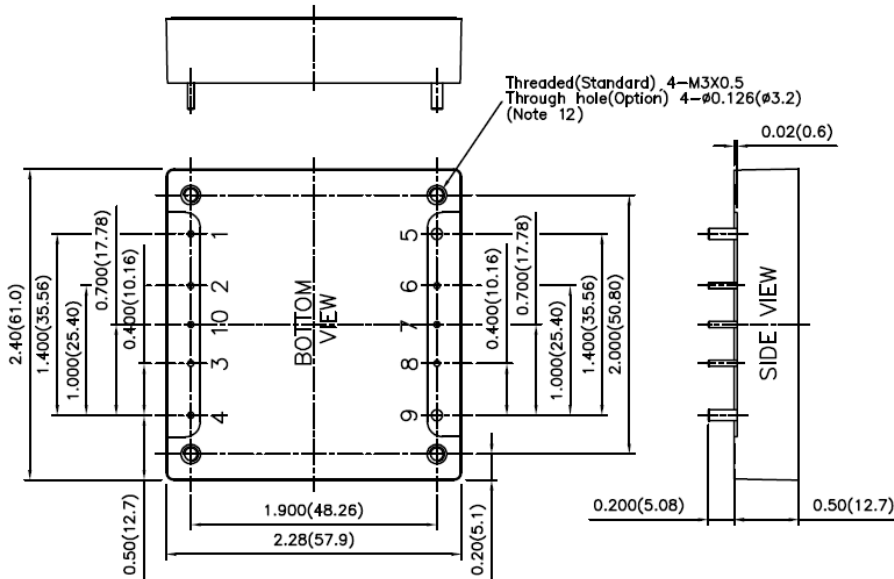
Output can be externally trimmed by using the method shown below.



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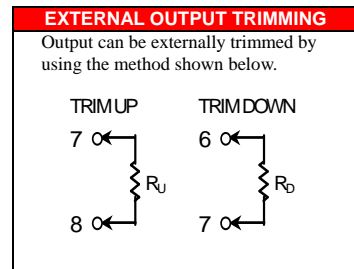
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Plastic case mechanical drawing: (110V input)



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



Part number structure:

HAE	150	-	48	S	05	W
SERIES NAME	Output Power		Input Voltage	Output Quantity	Output Voltage	4:1 Input Range
	150Watts		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	Y	C	HS
	Remote ON/OFF and pin length Options	Sync pin Options	Case pin Options	Heat-Sink Mounting Options
	L: Negative logic, 0.145" pin length P: Positive logic, 0.200" pin length S: Positive logic, 0.145" pin length	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.

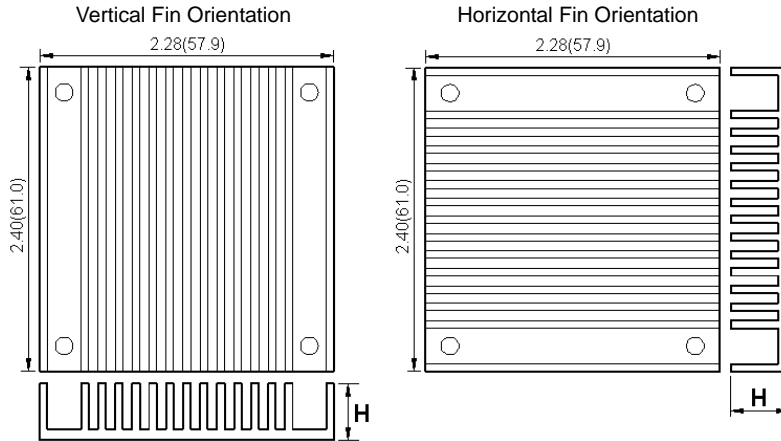
⁽³⁾ EMI filter meet EN55011, EN55022 Class A.

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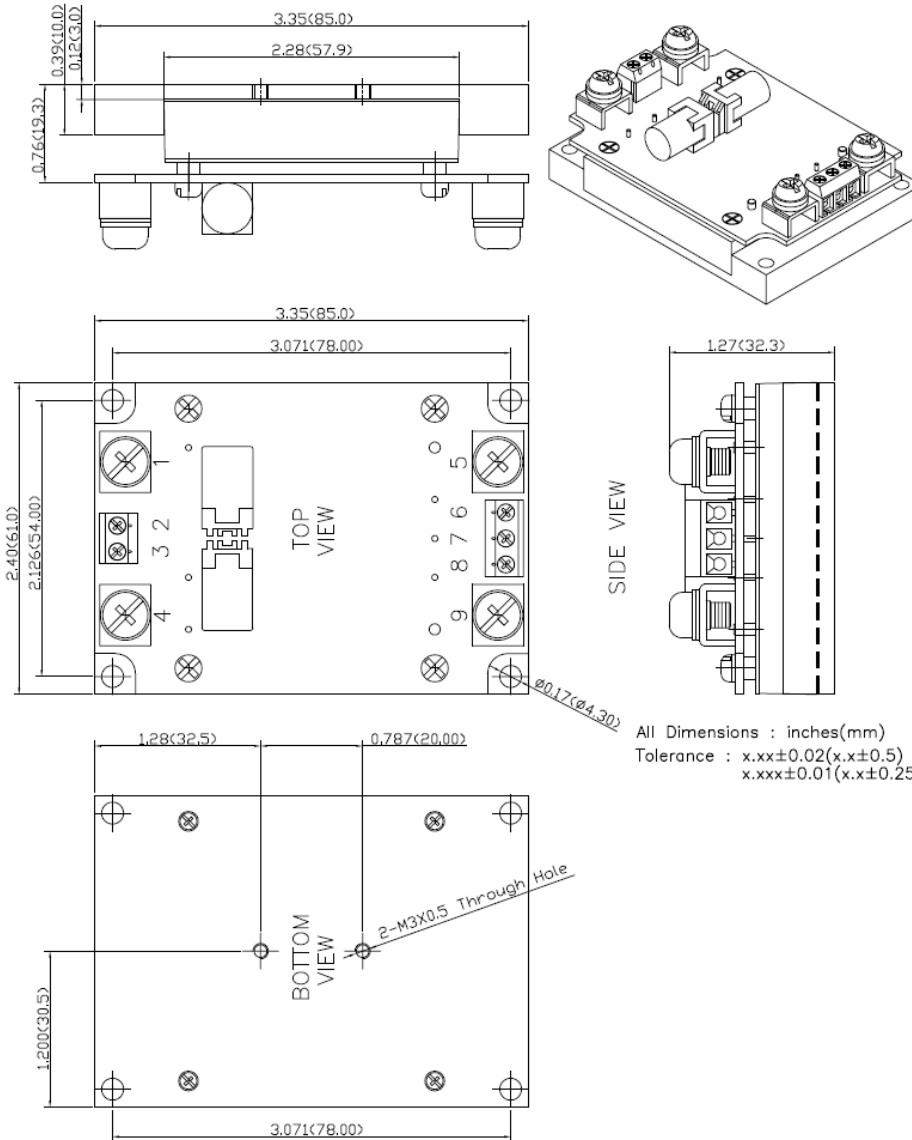
Heat-sink type:

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



Terminal block type mechanical drawings:

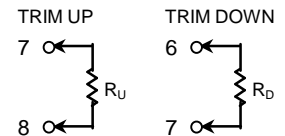
1) Terminal Block without EMC Filter, Suffix: -T



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

EXTERNAL OUTPUT TRIMMING

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

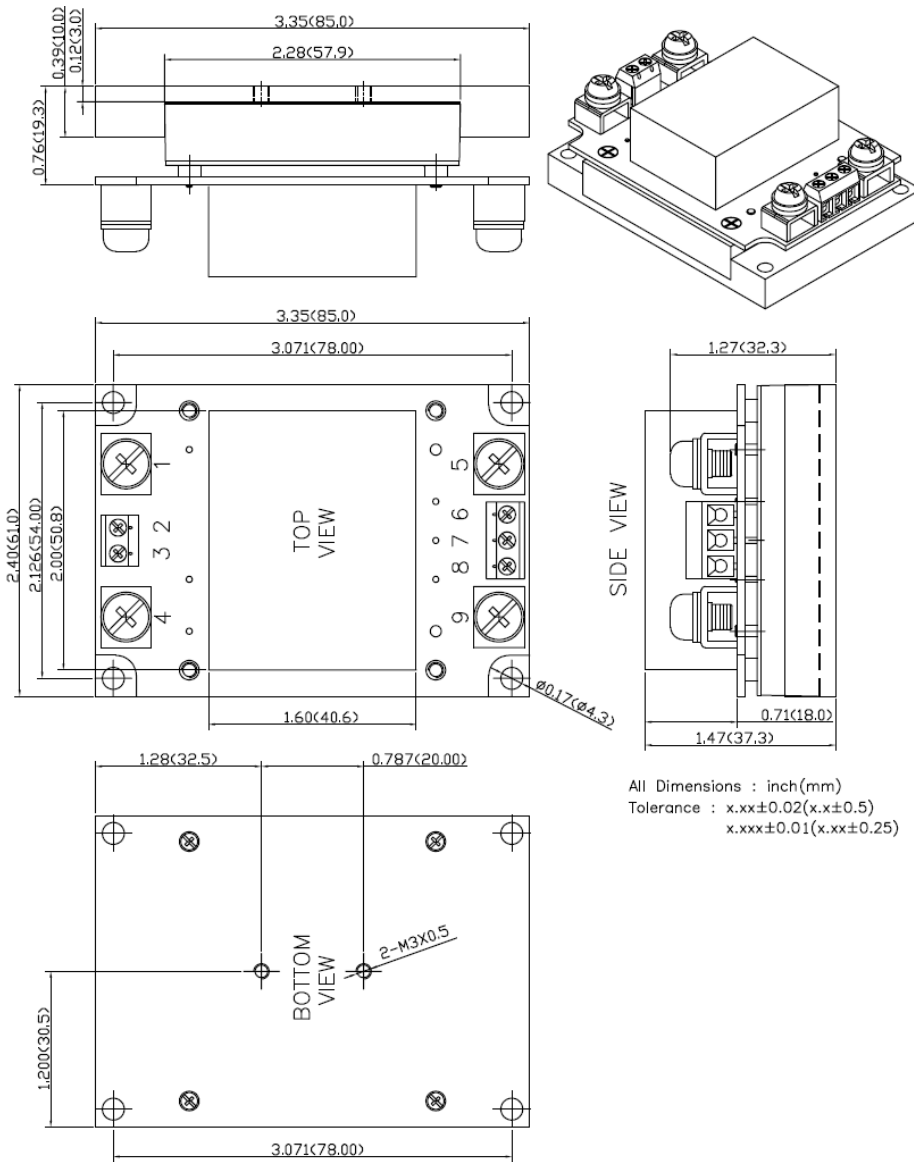


Note: These two M3x0.5 threaded holes are designed for Din Rail Clip assembly. The depth of heat-sink is allowed to be screwed into 2.8mm maximum. Customer shall take care as select the screw to avoid damaging the converter.

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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

EXTERNAL OUTPUT TRIMMING

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

TRIM UP

TRIM DOWN

Note: These two M3x0.5 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.

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

