AVE200 DC/DC Converter

Technical Reference Note

Industry Standard Half Brick : 36~75V Input, 3.3V, 1.2V Single Output

Industry Standard Half Brick: 2.4"X 2.28'' X 0.5''

Features

- **Delivers up to 40A output current**
- **Basic isolation**
- **Ultra High efficiency**
- **Improved thermal performance: 40A at 70ºC at 1.5ms-1（300LFM）**
- **High power density**
- **Low output noise**
- **Industry standard pinout**
- **2:1 wide input voltage of 36-75V**
- **CNT function**
- **Remote sense**
- **Trim function: +10%/-20%**
- **Input under-voltage lockout**
- **Output over-current protection**
- **Output over-voltage protection**
- **Over-temperature protection**
- **RoHS compliant**

Options

- Choice of positive logic or negative logic for CNT function
- Choice of short pins or long pins

Description

The AVE200 series is a new open frame DC-DC converter for optimum efficiency and power density. The AVE200 series provide up to 40A output current in an industry standard Half Brick, which makes it an ideal choice for small space, high current and low voltage applications. The AVE200 series uses an industry standard Half Brick: 61.0mm X 57.9mm X 12.7mm (2.4"x2.28"x0.5") and standard pinout configuration, provides CNT and trim functions. AVE200 series provide 3.3V@40A or 1.2V@40A single output, which is isolated from input. The series can achieve ultra high efficiency, for most applications a heat sink is required.

Contents

Module Numbering

AVE	200	—	48	S	3V3	P	-	4
1	2		3	4	5	6		7

Explanation:

1—Series name

2—Output rated power.

3—Input rated voltage.

4—Output number: S ---single output, D---dual output

5—Output rated voltage: 1V2---1.2V, 1V5---1.5V, 1V8---1.8V, 2V5---2.5V, 3V3---3.3V

6—CNT logic, P---positive logic control, default is negative logic control

7—Pin length:

-4---4.8 mm ± 0.5mm (0.189in. ± 0.02in.)

-6---3.80mm ± 0.5mm(0.150in. ± 0.020in.)

-8---2.80mm ± 0.5mm/-0.3mm(0.110in. ± 0.020in/-0.012in.)

By default: 5.8mm ± 0.5mm (0.228in. ± 0.02in.)

Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage and temperature conditions. Standard test condition on a single unit is as following:

Ta: 25 °C

+Vin: 48V ! 2%

Vin: Return pin for +Vin

CNT: Connect to -Vin

+Vout: Connect to load

Vout: Connect to load (return)

+Sense: Connect to +Vout

-Sense: Connect to -Vout

Trim (Vadj): Open

Input Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit	Note
Operating Input Voltage	All	V_I	36	48	75	V_{DC}	
Maximum Input Current	3.3V 1.2V	$I_{I,max}$	-	-	6.2 2	A	VI = 0 to VI,max, Io = Io,max
Input Reflected-ripple Current	All	I_I	-	-	20	mAp-p	5Hz to 20MHz: 12uH source impedance, T_A = 25 ºC.
Supply voltage rejection (1kHz)	All	-	45	-	-	dB	

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

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the IPS. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter		Device	Symbol	Min	Typ	Max	Unit	Note
Input Voltage	Continuous	All	VI	-	-	80	Vdc	
	Transient	All	VI, trans	-	-	100	Vdc	100ms
Operating Ambient Temperature		All	Ta	-40	-	70	ºC	See Thermal Consideration
Operating Board Temperature		All	Tc	-	-	100	ºC	
Storage Temperature		All	T_{STG}	-55	-	125	ºC	
Operating Humidity		All	-	-	-	95	%	
Basic Input-Output Isolation		All	-	1500	-	-	Vdc	50μA for 5 sec, slew rate of 1500V/10sec
Output Power		3.3V 1.2V	Po,max	-	-	132 48	W	

Output Specifications

Parameter		Device	Symbol	Min	Typ	Max	Unit	Conditions
Output Ripple and Noise Peak-to-Peak (5 Hz to 20 MHz)		3.3V 1.2V	-	-	-	150 80	mV	Across 1μF @10V, X7R ceramic capacitor & 2200μF @10V LOW ESR Aluminum capacitor
External Load Capacitance		All	-	470	-	10,000	μF	
Output Voltage Setpoint		3.3V 1.2V	Vo,set	3.25 1.18	3.3 1.2	3.35 1.22	Vdc	VI=VI,min to VI,max Io = Io,max; Ta = 25 ºC
Output Regulation	Line (Vi,min to Vi,max)	3.3V 1.2V		-	5 3	10 5	MV	Temperature (Tc = -40 ºC to +100ºC)
	Load (Io = Io,min to Io,max)	3.3V 1.2V		-	10 5	20 10	mv	
	Temperature Regulation (Whole range)	All		--	--	0.02	%Vo/ºC	
Rated Output Current			Io	0	-	40	A	
Output Current-limit Inceptio (Hiccup)		All	Io	44	-	56	A	
Efficiency		3.3V 1.2V	-	87 80	89 81	-	%	VI = VI,nom; Io,max ; TA = 25°C

Output Specifications (Cout)

Parameter		Device	Symbol	Min	Typ	Max	Unit	Note
Dynamic Response (ΔIo/Δt = 1A/10μs; VI = VI,nom ; TA = 25°C)	Peak Deviation:	3.3V 1.2V		-	-	165 80	mV	Load Change from Io = 50% to 75% or 50% to 25% of Io,max
	Settling Time (to Vo,nom):	3.3V 1.2V		-	-	300 300	μsec	
	Peak Deviation	3.3V 1.2V		-	-	200 120	mV	Load Change from Io = 50% to 100% or 50% to 0% of Io,max :
	Settling Time (to Vo,nom)	3.3V 1.2V		-	-	- -	μsec	
	Peak Deviation	3.3V 1.2V		-	-	330 160	mV	Load Change from Io = 10% to 100% of Io,max
	Settling Time (to Vo,nom)	3.3V 1.2V		-	-	- -	μsec	

Output Specifications (Cont)

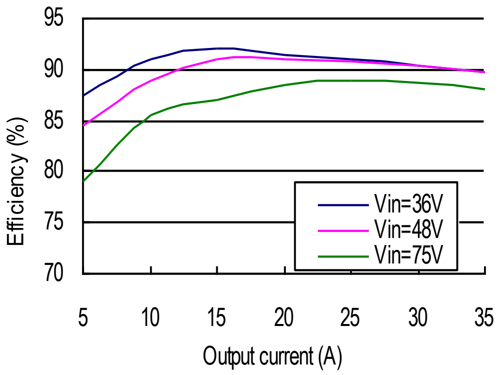
Parameter	Device	Symbol	Min	Typ	Max	Unit	Note
Turn-On Time	All	-	-	-	20	msec	Io = Io,max; Vo within 1%
Output Voltage Overshoot	All	-	-	None		%Vo	Io = Io,max; TA = 25°C
Switching Frequency	3.3V 1.2V	-		280 220		KHz	

Feature Specifications

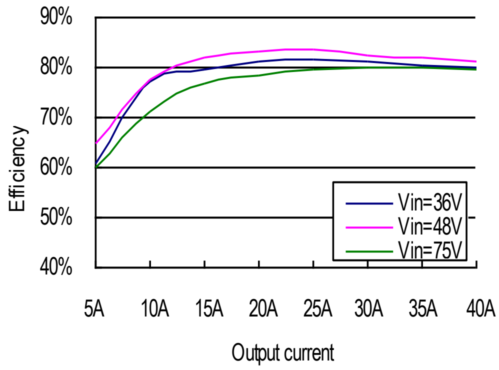
Parameter		Device	Symbol	Min	Max	Unit	Note
Enable pin voltage:	Logic Low	All	-	-0.7	1.2	V	
	Logic High	All	-	3.5	12	V	
Enable pin current:	Logic Low	All	-	-	1.0	mA	Leakage current, @10V
	Logic High	-	-	-		µA	
Output Voltage Adjustment Range		All		80	110	%Vo	-
Output Over-voltage (Hiccup)		3.3V 1.2V	Voclamp	3.75 1.4	5.00 2.0	V	-
Under-voltage Lockout	Turn-on Point	All	-	31	36	V	-
	Turn-off Point	All		30	35	V	
Isolation Capacitance		-	-	-	-	PF	
Isolation Resistance		All	-	10	-	MΩ	
Calculated MTBF		-		-	2,000 ,000	Hours	Io = Ionom ; Tc = 25°C
Weight		3.3V 1.2V		-	80 80	g(oz.)	
Vibration (Sine wave)		Vibration level: 3.5mm (2 ~ 9Hz), 10m/s^2 (9 ~ 200HZ),15m/s^2 (200 ~ 500HZ) Directions and time: 3 axis (X, Y, Z), 30 minutes each Sweep velocity: 1oct / min					
Shock (Half-sine wave)		Peak acceleration: 300m/s^2 Duration time: 6ms Continuous shock 3 times at each of 6 directions (± X, ± Y, ± Z)					

Characteristic Curves

Performance Curves – Efficiency

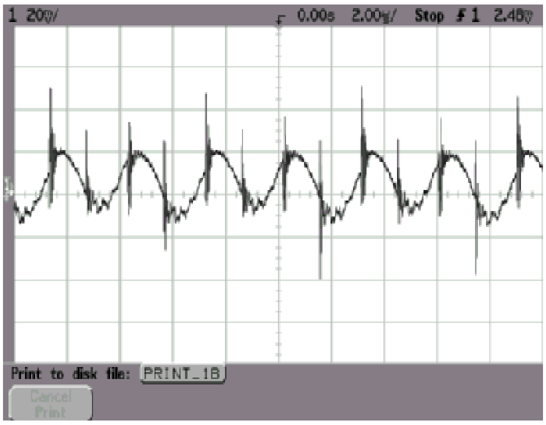


Typical Efficiency AVE200-48S3V3



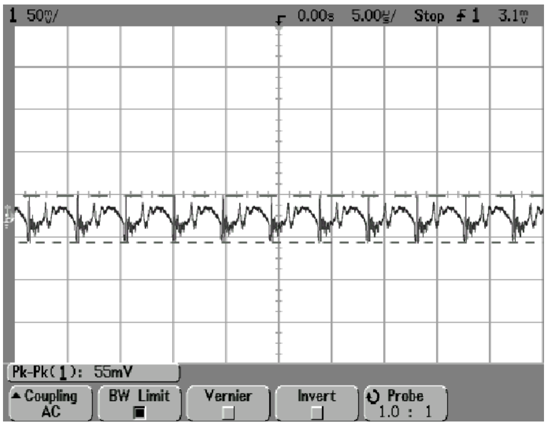
Typical Efficiency AVE200-48S1V2

Performance Curves – Output Performance Curves



AVE200-48S3V3 Typical output ripple voltage

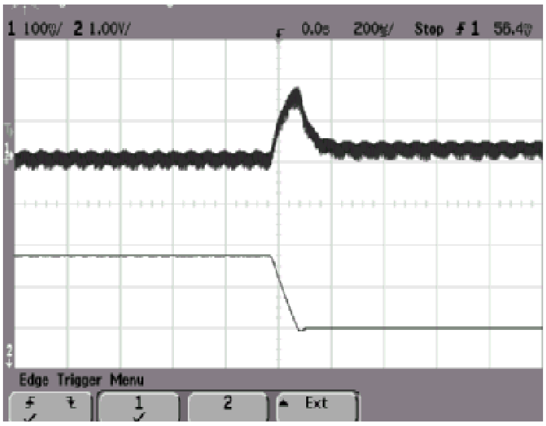
Room Temperature, Io = Io,max



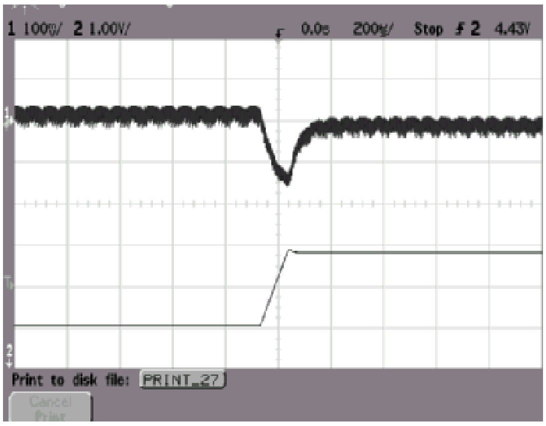
AVE200-48S1V2 Typical output ripple voltage

Room Temperature, Io = Io,max

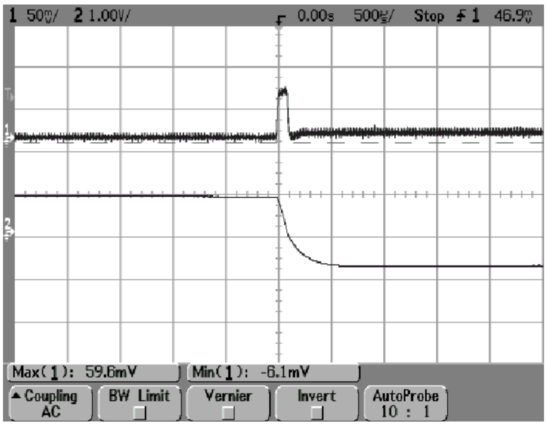
Performance Curves – Transient Response



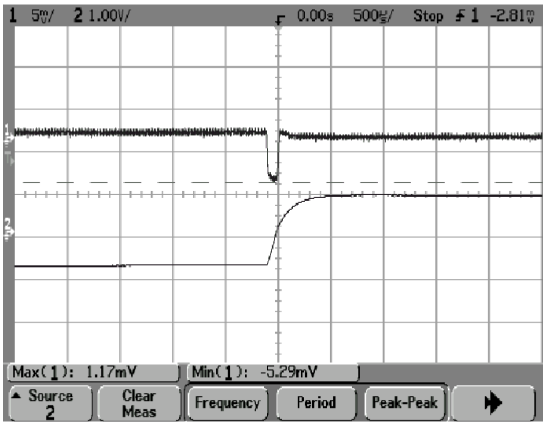
AVE200-48S3V3 Typical Transient Response to
Step Decrease in Load from 50% to 25%
of Full Load, Room Temperature, 48Vdc Input



AVE200-48S3V3.Typical Transient Response to
Step Increase in Load from 50% to 75%
of Full Load, Room Temperature, 48Vdc Input

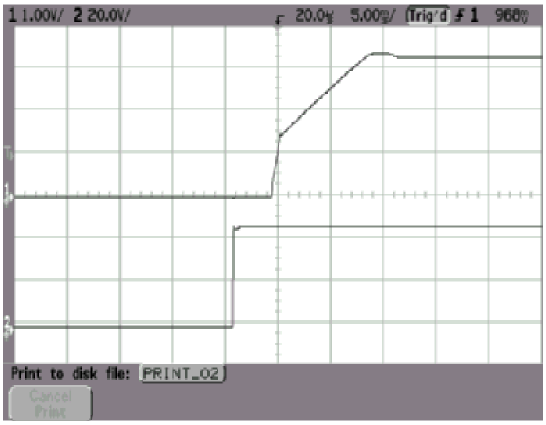


AVE200-48S1V2 Typical Transient Response to
Step Decrease in Load from 50% to 25%
of Full Load, Room Temperature, 48Vdc Input

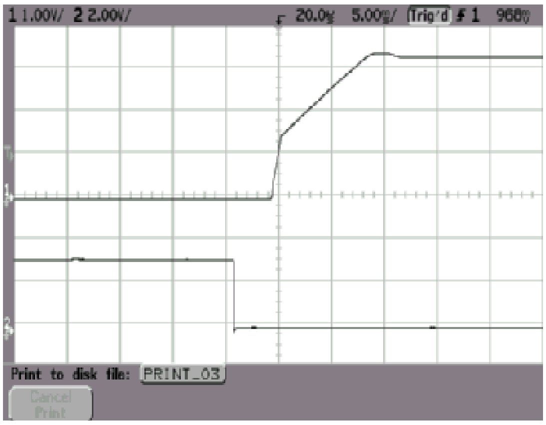


AVE200-48S1V2.Typical Transient Response to
Step Increase in Load from 50% to 75%
of Full Load, Room Temperature, 48Vdc Input

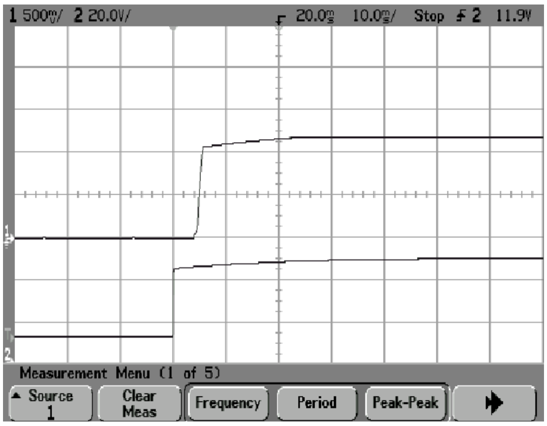
Performance Curves – Startup Characteristics



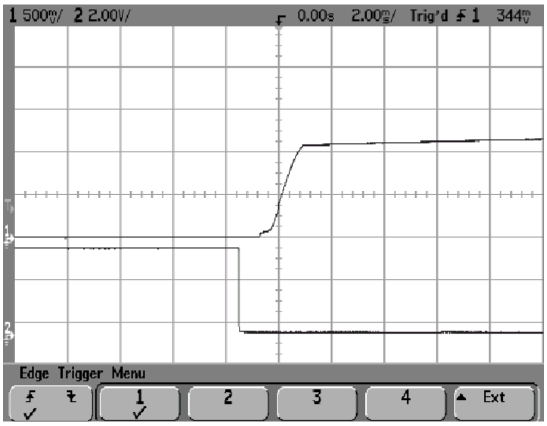
AVE200-48S3V3 Typical Start-up from Power On



AVE200-48S3V3 Typical Start-up from CNT On



AVE200-48S1V2 Typical Start-up from Power On



AVE200-48S1V2 Typical Start-up from CNT On

Feature Description

CNT Function

Two CNT logic options are available. The CNT logic, CNT voltage and the module working state are as the following table.

	L	H	OPEN
N	ON	OFF	OFF
P	OFF	ON	ON

N--- means “Negative Logic”

P--- means “Positive Logic”

L--- means “Low Voltage”, -0.7V≤L≤1.2V

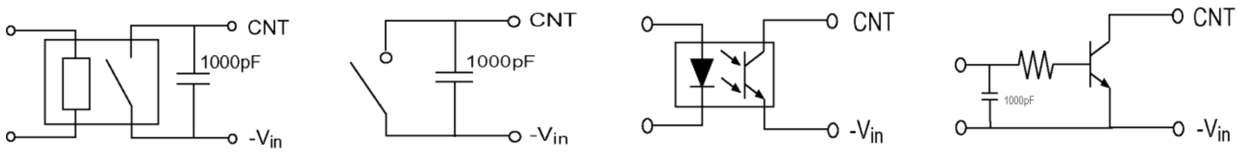
H--- means “High Voltage”, 3.5V≤H≤12V

ON--- means “Module is on”, OFF--- means “Module is off”

Open--- means “CNT pin is left open “

Note: When CNT is left open, V_{CNT} may reach 18V.

The following figure shows a few simple CNT circuits.



Relay CNT   Simple CNT   Isolated CNT   Transistor CNT

Remote Sense

The AVE200 converter can remotely sense both lines of its output which moves the effective output voltage regulation point from the output terminals of the unit to the point of connection of the remote sense pins. This feature automatically adjusts the real output voltage of the AVE200 in order to compensate for voltage drops in distribution and maintain a regulated voltage at the point of load.

When the converter is supporting loads far away, or is used with undersized cabling, significant voltage drop can occur at the load. The best defense against such drops is to locate the load close to the converter and to ensure adequately sized cabling is used. When this is not possible, the converter can compensate for a drop of up to 10%Vo, through use of the sense leads.

When used, the + Sense and - Sense leads should be connected from the converter to the point of load as shown in Figure 1, using twisted pair wire, or parallel pattern to reduce noise effect. The converter will then regulate its output voltage at the point where the leads are connected. Care should be taken not to reverse the sense leads. If reversed, the converter will trigger OVP protection and turn off.

When not used, the +Sense lead must be connected with +Vo, and -Sense with -Vo. Although the output voltage can be increased by both the remote sense and by tine trim, the maximum increase for the output voltage is not the sum of both.

The maximum increase is the larger of either the remote sense or the trim.

Note that at elevated output voltages the maximum power rating of the module remains the same, and the output current capability will decrease correspondingly.

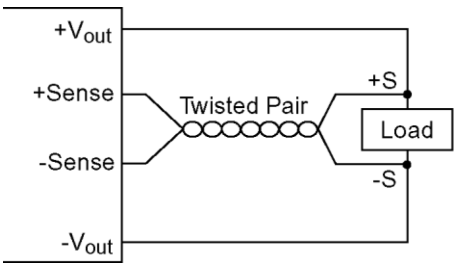


Figure 1 Sense connection

Trim

The +Vo output voltage of the AVE200 series can be trimmed using the trim pin provided. Applying a resistor to the trim pin through a voltage divider from the output will cause the +Vo output to increase by up to 10%or decrease by up to 20%. Trimming up by more than 10% of the nominal output may activate the OVP circuit or damage the converter. Trimming down more than 20% can cause the converter to regulate improperly. If the trim pin is not needed, it should be left open.

Trim up

With an external resistor connected between the TRIM and +SENSE pins, the output voltage set point increases (see Figure 2).

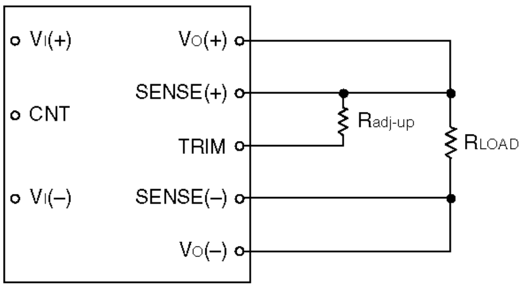


Figure 2 Trim up circuit

The following equation determines the required external-resistor value to obtain a percentage output voltage change of %.

For 3.3V:

$$R_{adj-up} = \frac{V_o \times (100 + \Delta\%)}{1.26 \times \Delta\%} - \frac{100 + 2 \times \Delta\%}{\Delta\%} (K\Omega)$$

For 1.2V:

$$Radj - up = \frac{2461 + 72.87 \times Vo \times (100 + \Delta\%)}{20.52 \times Vo \times (100 + \Delta\%) - 2461} (K\Omega)$$

Note: “☛” here is the trim range: -20 ~ +10.

Trim down

With an external resistor between the TRIM and -SENSE pins, the output voltage set point decreases (see Figure 3).

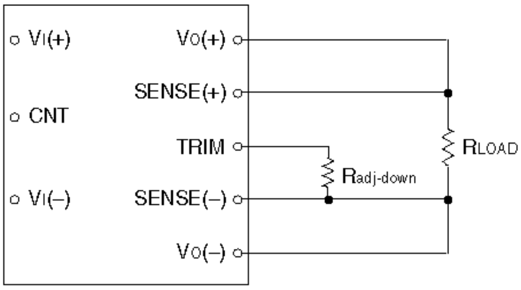


Figure 3 Trim down circuit

The following equation determines the required external-resistor value to obtain a percentage output voltage change of %.

For 3.3V：

$$R_{adj-down} = \frac{100}{\Delta\%} - 2(K\Omega)$$

For 1.2V:

$$Radj - down = \frac{2461 - 113.92 \times Vo \times (100 - \Delta\%)}{20.52 \times Vo \times (100 - \Delta\%) - 2461}(K\Omega)$$

Note: “☛” here is the trim range: -20 ~ +10.

Although the output voltage can be increased by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both. The maximum increase is the larger of either the remote sense or the trim.

Note that at elevated output voltages the maximum power rating of the module remains the same, and the output current capability will decrease correspondingly.

Minimum Load Requirements

There is no minimum load requirement for the AVE200 series modules.

Parameter	Device	Symbol	Typ	Unit
Minimum Load	All	I_{MIN}	0	A

Output Over-current Protection

AVE200 series DC/DC converters feature foldback current limiting as part of their Over-current Protection (OCP) circuits. When output current exceeds 110 to 140% of rated current, such as during a short circuit condition, the module will work on intermittent mode, also can tolerate short circuit conditions indefinitely. When the over-current condition is removed, the converter will automatically restart.

Output Capacitance

High output current transient rate of change (high di/dt) loads may require high values of output capacitance to supply the instantaneous energy requirement to the load. Tp minimize the output voltage transient drop during this transient, low Equivalent Series Resistance (ESR) capacitors may be required, since a high ESR will produce a correspondingly higher voltage drop during the current transient.

When the load is sensitive to ripple and noise, an output filter can be added to minimize the effects. A simple output filter to reduce output ripple and noise can be made by connecting a capacitor C1 across the output as shown in Figure 4. The recommended value for the output capacitor C1 is 2200 μF.

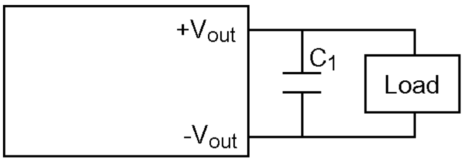


Figure 4　Output ripple filter

Extra care should be taken when long leads or traces are used to provide power to the load. Long lead lengths increase the chance for noise to appear on the lines. Under these conditions C2 can be added across the load, with a 1μF ceramic capacitor C3 in parallel generally as shown in Figure 5.

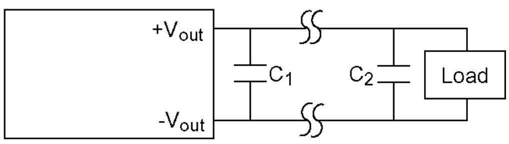


Figure 5　Output ripple filter for a distant load

Decoupling

Noise on the power distribution system is not always created by the converter. High speed analog or digital loads with dynamic power demands can cause noise to cross the power inductor back onto the input lines. Noise can be reduced by decoupling the load. In most cases, connecting a 10uF tantalum or ceramic capacitor in parallel with a 0.1μF ceramic capacitor across the load will decouple it. The capacitors should be connected as close to the load as possible.

Ground Loops

Ground loops occur when different circuits are given multiple paths to common or earth ground, as shown in Figure 6. Multiple ground points can slightly different potential and cause current flow through the circuit from one point to another. This can result in additional noise in all the circuits. To eliminate the problem, circuits should be designed with a single ground connection as shown in Figure 7.

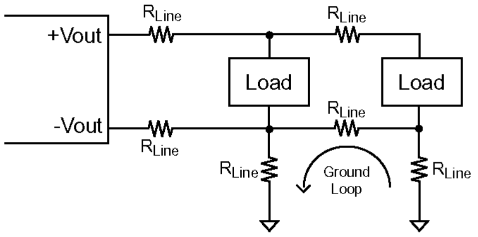


Figure 6 Ground loops

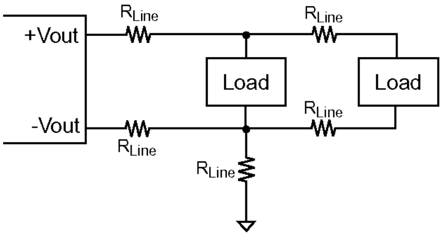


Figure 7 Single point ground

Output Over-Voltage Protection

The output over-voltage protection consists of circuitry that monitors the voltage on the output terminals. If the voltage on the output terminals exceeds the over voltage protection threshold, then the module will work on intermittent mode. When the over-voltage condition is removed, the converter will automatically restart.

The protection mechanism is such that the unit can continue in this condition until the fault is cleared.

Over-Temperature Protection

These modules feature an over-temperature protection circuit to safeguard against thermal damage. the module will work on intermittent mode when the maximum device reference temperature is exceeded. When the over-temperature condition is removed, the converter will automatically restart.

Design Consideration

Typical Application

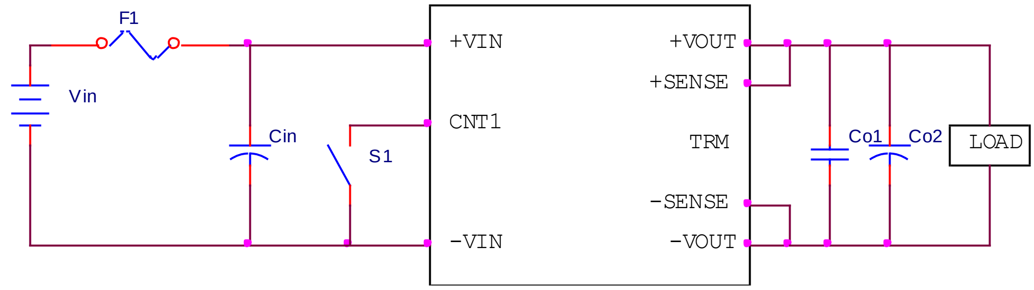


Figure 8 Typical application

F1: Fuse*: Use external fuse (fast blow type) for each unit.

For 3.3V output: 10A (Pout=132W)

For 1.2V output: 5A (Pout=48W)

Cin: Recommended input capacitor

100 µF/100V high frequency low ESR electrolytic type capacitor .

Co1: Recommended 1 µF /10V ceramic capacitor

Co2: Recommended output capacitor

Recommended 2200 µF/10V high frequency low ESR electrolytic type capacitor.

If Ta<-5℃, use 220 µF tantalum capacitor parallel with a 2200 µF/ 10V high frequency low ESR electrolytic capacitor.

Note: The AVE200 modules cannot be used in parallel mode directly!

Fusing

The AVE200 power modules have no internal fuse. An external fuse must always be used! To meet international safety requirements, a 250 Volt rated fuse should be used. If one of the input lines is connected to chassis ground, the fuse must be placed in the other input line.

Standard safety agency regulations require input fusing. Recommended fuse ratings for the AVE200 Series are shown as following list.

For 3.3V output: 10A (Pout=132W)

For 1.2V output: 5A (Pout=48W)

Note: The fuse is fast blow type.

Input Reverse Voltage Protection

Under installation and cabling conditions where reverse polarity across the input may occur, reverse polarity protection is recommended. Protection can easily be provided as shown in Figure 9. In both cases the diode used is rated for 10A/100V. Placing the diode across the inputs rather than in-line with the input offers an advantage in that the diode only conducts in a reverse polarity condition, which increases circuit efficiency and thermal performance.

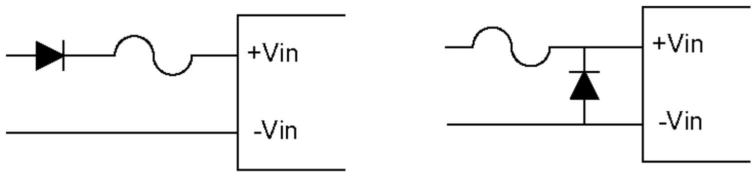


Figure 9 Reverse polarity protection circuit

EMC

For conditions where EMI is a concern, a different input filter can be used. Figure 10 shows a filter designed to reduce EMI effects. AVE200 series can meet EN55022 CLASS A with Figure 10.

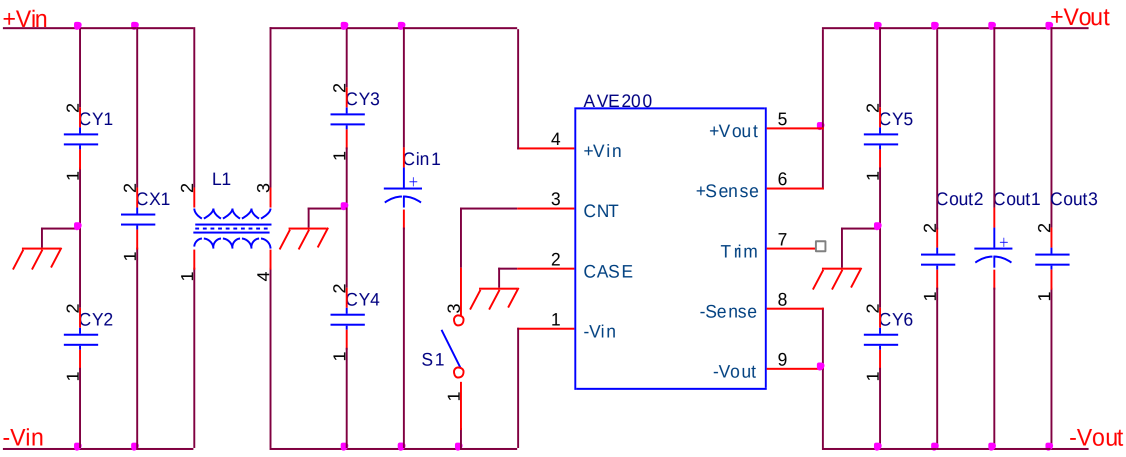


Figure 10   EMI reduction filter

Recommended values:

CX1	2.2uF/100V
CY1,CY2	1000P/2KV
CY3,CY4	0.1uF/100V
Cin1	100uF/100V
CY5,CY6	4700P/2KV
Cout1	2200uF/10V
Cout2	0.1uF/50V
Cout3	0.01uF/50V
L1	3.6mH

Safety Consideration

For safety-agency approval of the system in which the power module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard, i.e., UL1950, CSA C22.2 No. 950-95, and EN60950. The AVE200 series input-to-output isolation is a basic insulation. The DC/DC power module should be installed in end-use equipment, in compliance with the requirements of the ultimate application, and is intended to be supplied by an isolated secondary circuit. When the supply to the DC/DC power module meets all the requirements for SELV (<60Vdc), the output is considered to remain within SELV limits (level 3). If connected to a 60Vdc power system, double or reinforced insulation must be provided in the power supply that isolates the input from any hazardous voltages, including the ac mains. One input pin and one output pin are to be grounded or both the input and output pins are to be kept floating. Single fault testing in the power supply must be performed in combination with the DC/DC power module to demonstrate that the output meets the requirement for SELV. The input pins of the module are not operator accessible.

Note: Do not ground either of the input pins of the module without grounding one of the output pins. This may allow a non-SELV voltage to appear between the output pin and ground.

Thermal Consideration

Technologies

AVE200 modules have ultra high efficiency at full load. With less heat dissipation and temperature-resistant components such as ceramic capacitors, these modules exhibit good behavior during pro-longed exposure to high temperatures. Maintaining the operating board temperature within the specified range help keep internal component temperatures within their specifications which in turn help keep MTBF from falling below the specified rating. Proper cooling of the power modules is also necessary for reliable and consistent operation.

Basic Thermal Management

Measuring the board temperature of the module as the method shown in Figure 11 can verify the proper cooling.

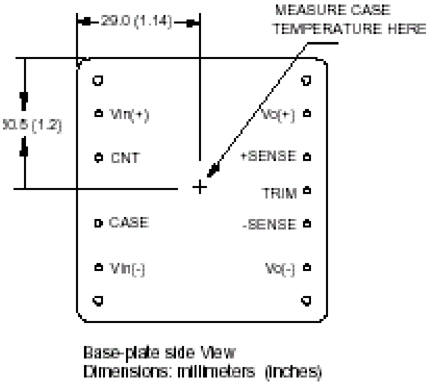


Figure 11 Temperature measurement location

The module should work under 70°C ambient for the reliability of operation and the board temperature must not exceed 100 °C while operating in the final system configuration. The measurement can be made with a surface probe after the module has reached thermal equilibrium. No heat sink is mounted, make the measurement as close as possible to the indicated position. It makes the assumption that the final system configuration exists and can be used for a test environment. Note that the board temperature of module must always be checked in the final system configuration to verify proper operational due to the variation in test conditions. Thermal management acts to transfer the heat dissipated by the module to the surrounding environment. The amount of power dissipated by the module as heat (PD) is got by the equation below:

PD = PI - PO

Where: PI is input power; PO is output power; PD is dissipated power.

Also, module efficiency (η) is defined as the following equation:

η = PO / PI

By eliminating the input power term, the two above equations can yield the equation below:

PD = PO (1- η) / η

The module power dissipation then can be calculated through the equation.

Each power module output voltage has a different power dissipation curve, the following figures show the typical power dissipation curves of AVE200 series.

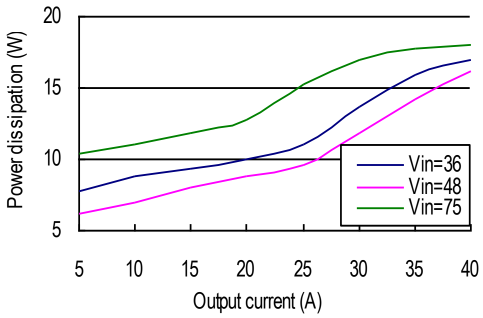


Figure 12 Typical power dissipation AVE200-48S3V3

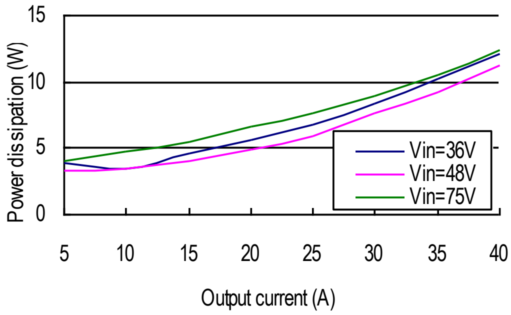


Figure 13 Typical power dissipation of AVE200-48S1V2

Module Derating

Experiment Setup

From the experimental set up shown in Figure 14, the derating curves as figures 15 & 16 can be drawn. Note that the Printed Wiring Board (PWB) and the module must be mounted vertically. The Passage has a rectangular cross-section. The clearance between the facing PWB and the top of the module is kept 13 mm (0.5 in.) constantly.

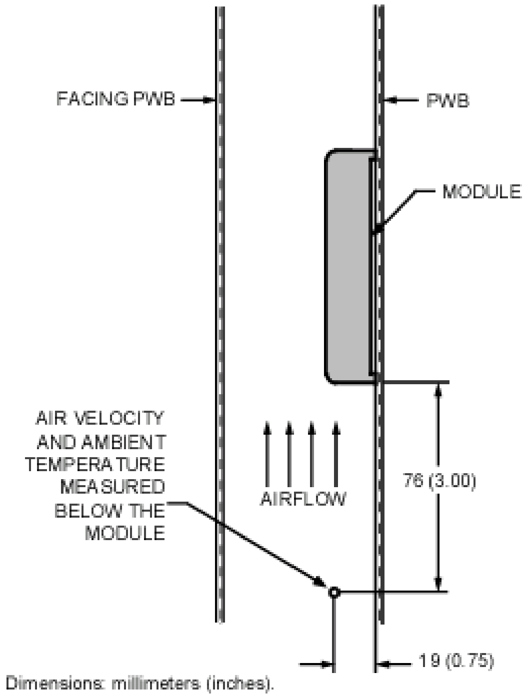


Figure 14 Experiment setup

Convection Without Heat Sinks

Heat transfer can be enhanced by increasing the airflow over the module. Figures 15 and 16 show the change of the module output current with the change of ambient temperature. In the test, the airflow was created with externally adjustable fans. The appropriate airflow for a given operating condition can be determined through these figures.

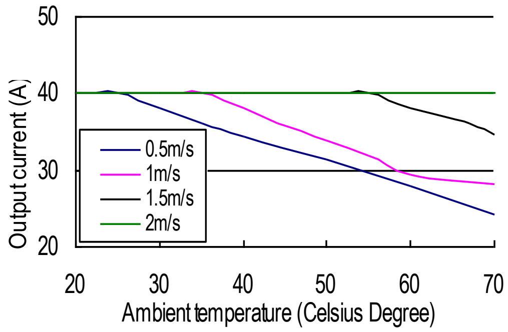


Figure 15 Forced convection power derating without heat sink of AVE200-48S3V3

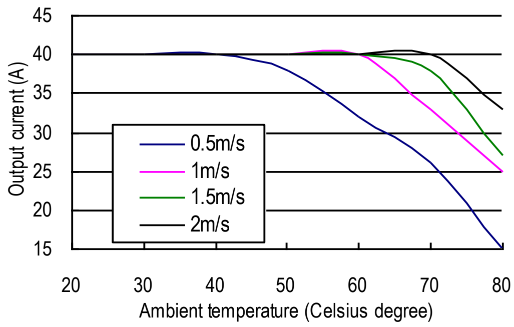


Figure 16 Forced convection power derating without heat sink of AVE200-48S1V2

Heat Sink Configuration

Several standard heat sinks available for the AVE200 series are shown in figures 17 to 19.

The heat sinks mounted to the top surface of the module with screws torqued to 0.56 N-m (5 in.-Ib). A thermally conductive dry pad or thermal grease is placed between the case and the heat sink to minimize contact resistance (typically 0.1℃/W to 0.3℃/W) and temperature differential.

Nomenclature for heat sink configurations is as follows:

WDxyyyy40

x = fin orientation: longitudinal (L) or transverse (T)

yyy = heat sink height (in 100ths of inch)

For example, WDT5040 is a heat sink that is transverse mounted for a 61mm × 57.9mm (2.4in. × 2.28 in.) module with a heat sink height of 0.5 in.

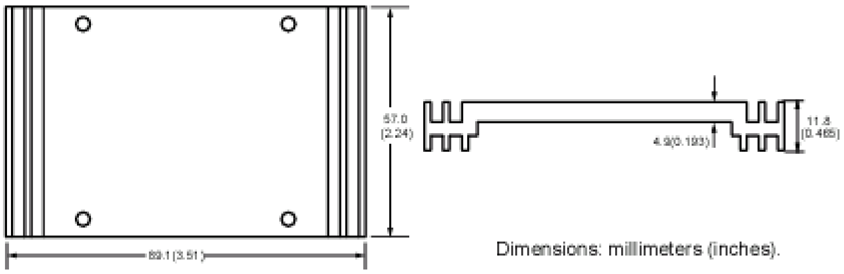


Figure 17 Non-standard heatsink

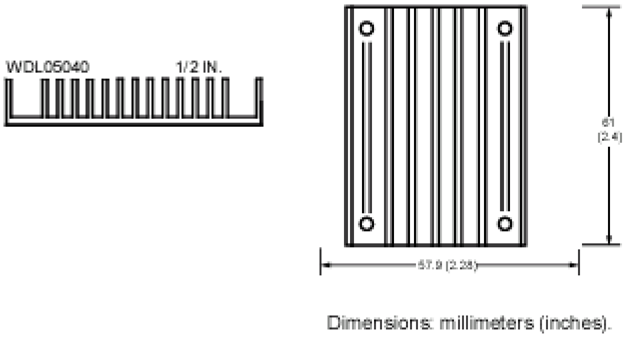


Figure 18　Longitudinal fins heat sink

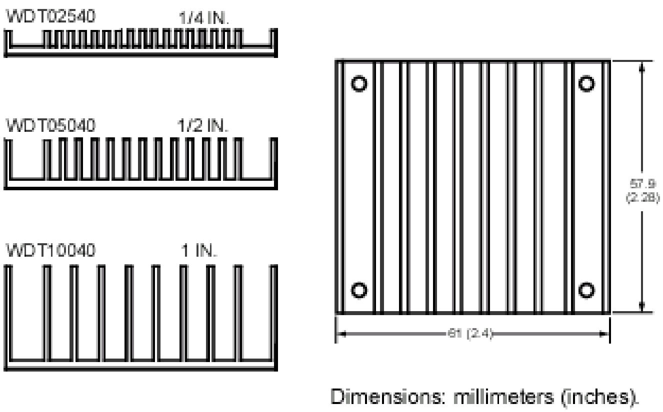


Figure 19　Transverse fins heat sink

Heat Sink Mounting

A crucial part of the thermal design strategy is the thermal interface between the baseplate of the module and the heatsink. Inadequate measures taken will quickly negate any other attempts to control the baseplate temperature. For example, using a conventional dry insulator can result in a case-heatsink thermal impedance of >0.5^{o}C/W, while using one of the recommended interface methods (silicon grease or thermal pads) can result in a case-heatsink thermal impedance around 0.1^{o}C/W.

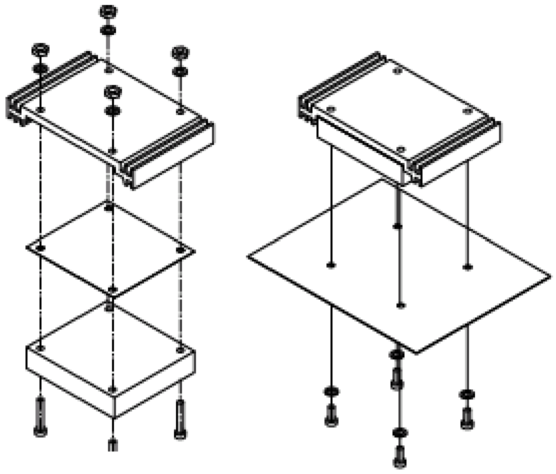


Figure 20 Heat sink mounting

Natural Convection with Heat Sink

The power derating for a module with the heat sink in natural convection is shown in figures 21 and 22. In this test, natural convection generates airflow about 0.05m/s to 0.1m/s (10ft/min to 20ft/min). Figure 21 and 22 can be used for heat-sink selection in natural convection environment.

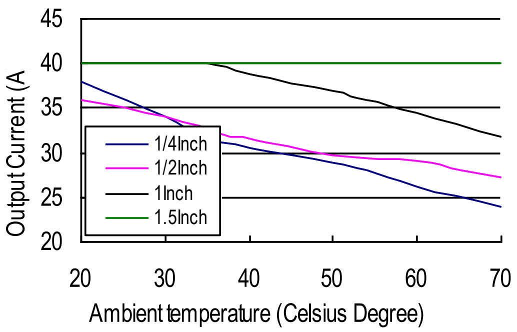


Figure 21 Heat sink power derating curves, natural convection, AVE200-48S3V3

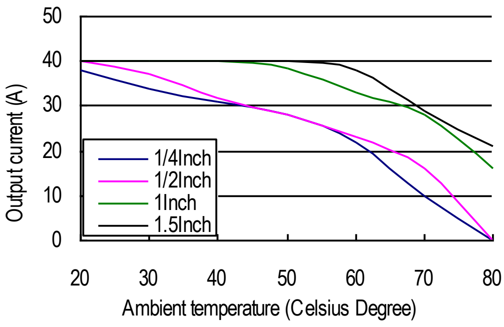


Figure 22 Heat sink power derating curves, natural convection, AVE200-48S1V2

Installation

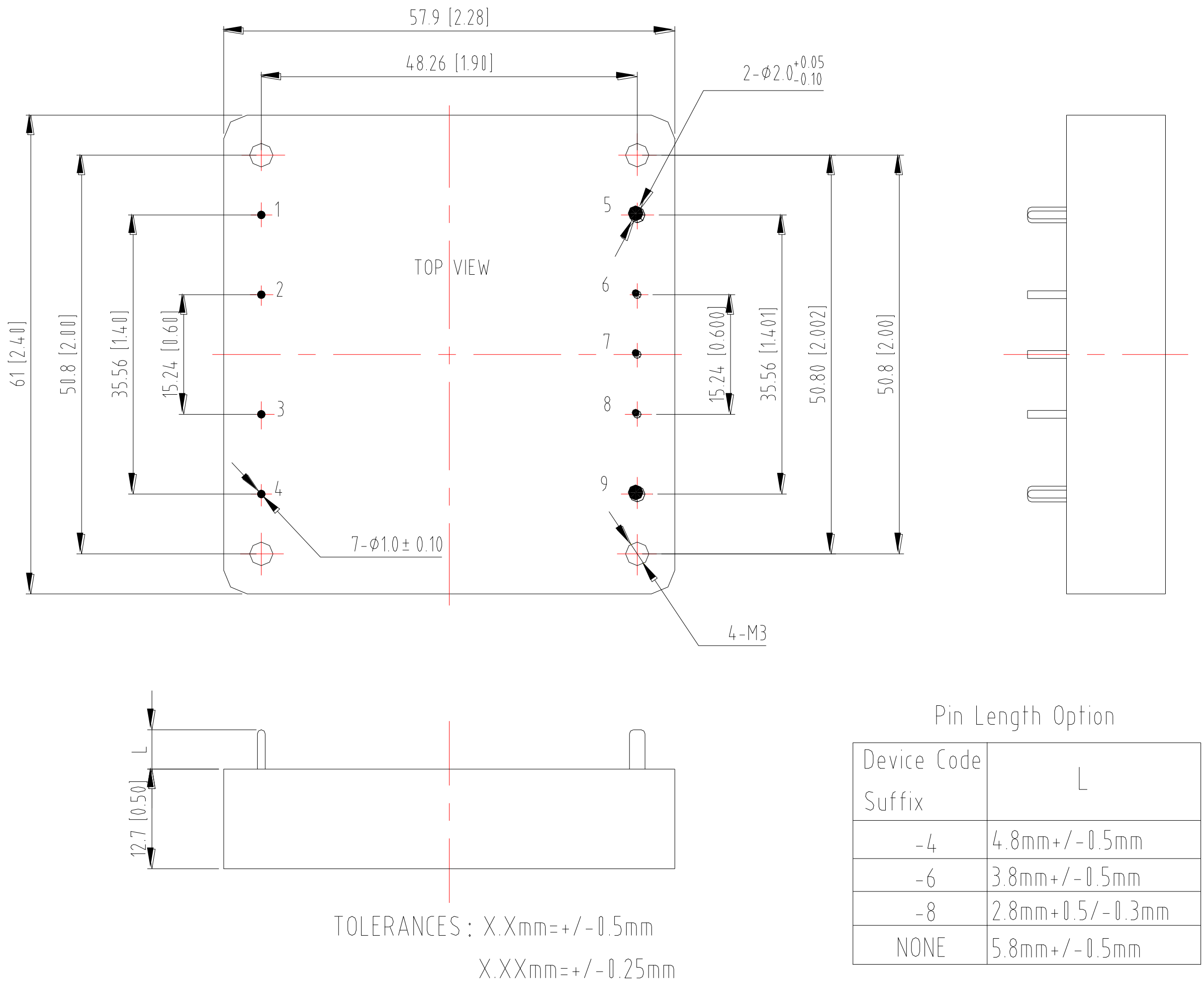
Although AVE200 series converters can be mounted in any orientation, free air-flowing is always necessary. Normally, power components are located at the end of the airflow path or have separate airflow paths so as to keep other system equipment cooler and increase component life spans.

Soldering

AVE200 series converters are compatible with standard wave soldering techniques. When wave soldering, the converter pins should be preheated for 20-30 seconds at 110℃, and wave soldered at 260℃ for less than 10 seconds.

When hand soldering, the iron temperature should be maintained at 425℃ and applied to the converter pins for less than 5 seconds. Longer exposure can cause internal damage to the converter. Cleaning can be performed with cleaning solvent IPA or with water.

Mechanical Chart



Pin Length Option

Device Code Suffix	L
-4	4.8mm+/-0.5mm
-6	3.8mm+/-0.5mm
-8	2.8mm+0.5/-0.3mm
NONE	5.8mm+/-0.5mm

PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	Vin(+)	5	Vo(+)
2	CNT	6	+SENSE
3	CASE	7	TRIM
4	Vin(-)	8	-SENSE
		9	Vo(-)

Notes: Un-dimensioned components are for visual reference only.

Ordering Information

Model Number	Input Voltage (V)	Output Voltage (V)	Output Current (A)	Ripple and Noise (mV pp)		Efficiency (%)
				Typ.	Max.	Typ.
AVE200-48S3V3	36-75	3.3	40	80	150	89
AVE200-48S1V2	36-75	1.2	40	-	80	81