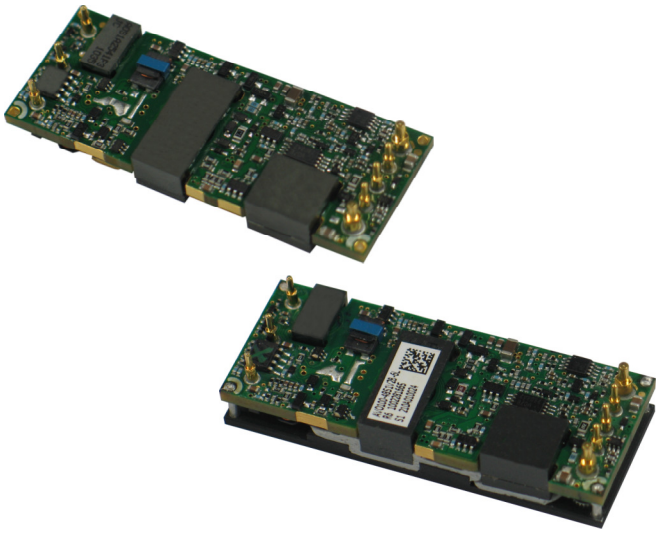
AVO100B-48S1V5

60 Watts

Eighth-brick Converter

Total Power: 60 Watts
Input Voltage: 36 to 75 Vdc
# of Outputs: Single



Special Features

- Delivers up to 40A output current
- Industry standard Eighth-brick
- Basic isolation
- Ultra high efficiency 90.7% typ. at 60% load
- 2:1 wide input voltage of 36-75V
- CNT function
- Remote sense
- Trim function: -20% to +10%
- Input under-voltage lockout
- Output over-current protection
- Output over-voltage protection
- Over-temperature protection
- RoHS compliant
- Standard module with base plate
- Pin length option: 3.8mm
- Excellent thermal performance
- No minimum load requirement
- Intended for reflow or wave soldering

Safety

IEC/EN/UL/CSA 60950 2nd
2006/95/EEC CE Mark
GB4943
UL/TUV
UL94,V-0
FCC/EN55022 Class A

Product Descriptions

The AVO100B-48S1V5 is a single output DC/DC converter with standard eighth-brick form factor and pin configuration. It delivers up to 40A output current with 1.5V output. Ultra-high 90.7% efficiency and excellent thermal performance makes it an ideal choice for use in datacom and telecommunication applications and can operate over an ambient temperature range of -40 ^{O}C ~ +85 ^{O}C.

Applications

Telecom/ Datacom

ARTESYN™
EMBEDDED TECHNOLOGIES

Model Numbers

Standard	Output Voltage	Structure	Remote ON/OFF logic	ROHS
AVO100B-48S1V5	1.5Vdc	Open-frame	Negative	R6
AVO100B-48S1V5P	1.5Vdc	Open-frame	Negative	R6
AVO100B-48S1V5B	1.5Vdc	Open-frame	Negative	R6
AVO100B-48S1V5PB	1.5Vdc	Open-frame	Positive	R6
AVO100B-48S1V5	1.5Vdc	Base plate	Negative	R6
AVO100B-48S1V5P	1.5Vdc	Base plate	Positive	R6
AVO100B-48S1V5B	1.5Vdc	Base plate	Negative	R6
AVO100B-48S1V5PB	1.5Vdc	Base plate	Positive	R6

Ordering information

AVO100B	-	48	S	1V5	P	B	-	6	L
①		②	③	④	⑤	⑥	⑦		⑧

①	Model series	AVO100: series name
②	Input voltage	48: input rated voltage 48V
③	Output number	S: single output
④	Rated output voltage	1V5 - 1.5V
⑤	Remote ON/OFF logic	Default: negative logic; P: positive logic
⑥	Baseplate	Default: without the baseplate, B:with baseplate
⑦	Pin length	6: 3.8mm
⑧	RoHS status	L: RoHS, R6; Y: RoHS, R5

Options

None

Electrical Specifications

Absolute Maximum Ratings

Stress in excess of those listed in the "Absolute Maximum Ratings" may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply's reliability.

Table 1. Absolute Maximum Ratings:

Parameter	Model	Symbol	Min	Typ	Max	Unit
Input Voltage						
Operating -Continuous	All	$V_{IN,DC}$	0	-	80	Vdc
Non-operating -100mS	All		0	-	100	Vdc
Maximum Output Power	All	$P_{O,max}$	-	-	60	W
Isolation Voltage[1]						
Input to outputs	Open frame modules		-	-	2250	Vdc
Input to baseplate	Baseplate modules		-	-	1500	Vdc
Outputs to baseplate	Baseplate modules		-	-	750	Vdc
Ambient Operating Temperature	All	T_A	-40	-	+85	^{O}C
Operating board temperature	All	Tc	-40	-	+110	^{O}C
Storage Temperature	All	T_{STG}	-55	-	+125	^{O}C
Humidity (non-condensing)						
Operating	All		-	-	95	%
Non-operating	All		-	-	95	%

Note 1 - 1mA for 1min, slew rate of 2000V/10s

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, DC	All	$V_{IN,DC}$	36	48	75	Vdc
Turn-on Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,ON}$	31	-	36	Vdc
Turn-off Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,OFF}$	30	-	35	Vdc
Lockout voltage hysteresis	All	-	1	-	3	V
Maximum Input Current ($I_O = I_{O,max}$)	$V_{IN,DC} = 36V_{DC}$, $I_O = I_{O,max}$	$I_{IN,max}$	-	-	3.5	A
No-load input current	$I_O = 0A$	I_{IN,no_load}	-	0.05	-	A
Standby Input current	$I_O = 0A$, Vout=0V	$I_{IN,standby}$	-	0.005	0.015	A
Inrush current transient rating			-	-	1	A^2s
Recommended Input Fuse	Fast blow external fuse recommended		-	-	10	A
Recommended External Input Capacitance	Low ESR capacitor recommended	C_{IN}	100	-	-	uF
Input Reflected Ripple Current	5Hz to 20MHz, 12uH source impedance, TA = 25 ºC		-	40	-	mA
Operating Efficiency	T_A=25 °C $I_O = I_{O,max}$ $I_O = 50\%I_{O,max}$ $I_O = 20\%I_{O,max}$	η	- - -	89 90.7 87.5	- - -	% % %
Factory Set Voltage	VI = VI,min to VI,max: Io = Io,max; Ta = 25 ºC	V_O	1.48	1.5	1.52	Vdc
Output Voltage Line Regulation	$V_{IN,DC} = V_{IN,DC.min}$ to $V_{IN,DC.max}$	$\%V_O$	-	±0.1	±0.2	%
Output Voltage Load Regulation	I_O=$I_{O,min}$ to $I_{O,max}$	$\%V_O$	-	±0.1	±0.2	%
Output Voltage Temperature Regulation	Tc = -40 ºC to +100ºC	$\%V_O$	-	-	0.02	%/°C

Output Specifications

Table 3. Output Specifications:

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output Voltage Trim Range	All	V_O	1.2	-	1.65	Vdc
Total output voltage range	Over sample, line, load, temperature & life		1.45	1.5	1.55	Vdc
Output Ripple and Noise Peak-to-Peak	Measure with a 1uF ceramic capacitor in parallel with a 10uF tantalum capacitor, 0 to 20MHz bandwidth	V_O	-	50	-	mV_{PK-PK}
Output Current	All	Io	0	-	40	A
Output DC current-limit inception[1]	All	Io	42	-	57	A
External Load Capacitance[2]	All	C_O	330	-	40000	µF
Dynamic Response Peak Deviation Settling Time	25%~50%~25% 25% load change slew rate = 0.1A/us	$\pm V_O$ T_s	- -	40 150	- -	mV uSec
	25%~50%~25% 25% load change slew rate = 1A/us	$\pm V_O$ T_s	- -	100 200	- -	mV uSec

Note 1 - Hiccup: auto-restart when over-current condition is removed.
Note 2 - High frequency and low ESR is recommended.

Output Specifications

Table 3. Output Specifications, con't:

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Turn-on transient	Rise time	$I_O = I_{max}$	T_{rise}	-	5	50	mS
	Turn-on delay time	$I_O = I_{max}$	$T_{turn\ on\ delay}$	-	62	200	mS
	Output voltage overshoot	$I_O = 0$	$\%V_O$	-	0	-	%
Switching frequency		All	f_{SW}	-	165	-	KHz
Remote ON/OFF control (positive logic)	Off-state voltage	All		-0.7	-	1.2	V
	On-state voltage	All		3.5	-	12	V
Remote ON/OFF control (negative logic)	Off-state voltage	All		3.5	-	12	V
	On-state voltage	All		-0.7	-	1.2	V
Output over-voltage protection[3]		All		1.75	-	2.6	V
Output over-temperature protection[4]		All	T	-	118	-	^{O}C
MTBF		$V_{IN,DC}$ = 48Vdc, 100% load, 25 ^{O}C T_A		-	1.5	-	10^6 h

Note 3 - Hiccup: auto-restart when over-voltage condition is removed.
Note 4 - Auto recovery.

AVO100B-48S1V5 Series Performance Curves

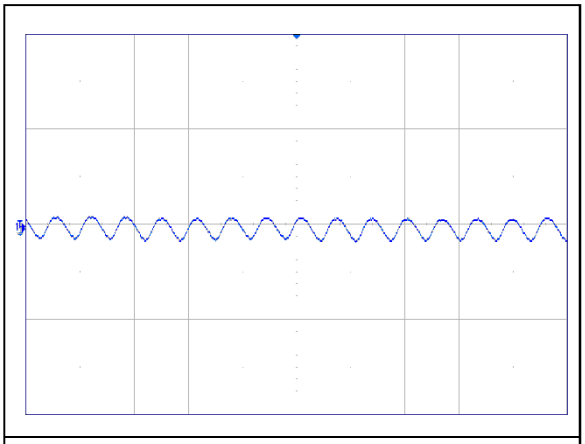


Figure 1: AVO100B-48S1V5 Input reflected ripple current (5µs/div)

Ch 1: Vo (10mA/div)

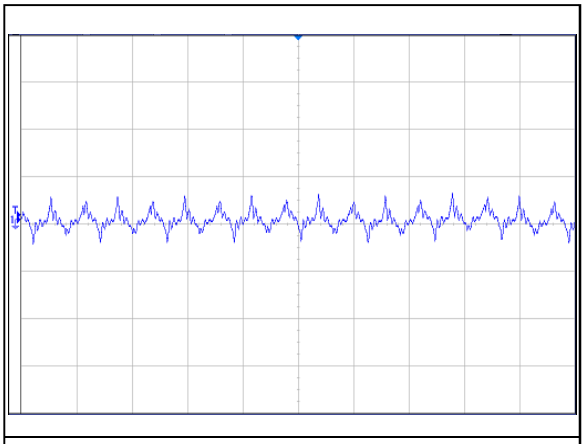


Figure 2: AVO100B-48S1V5 Ripple and Noise Measurement (5µs/div)

Ch 1: Vo (50mV/div) 5µs/div

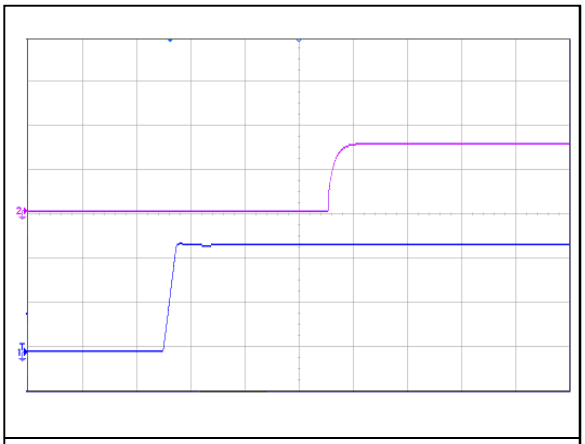


Figure 3: AVO100B-48S1V5 Output Startup by Power On(50ms/div)

Ch 1: Vin (20V/div) Ch 2: Vout (1V/div)

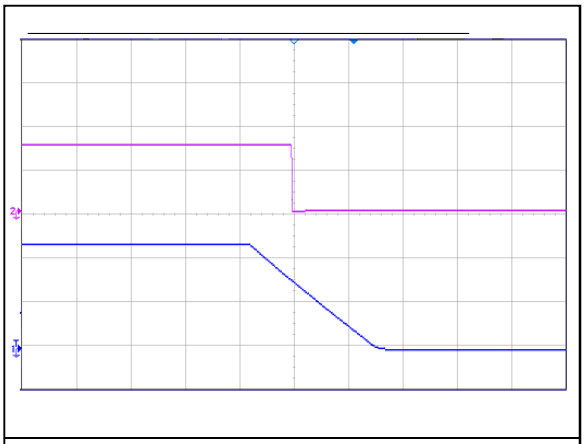


Figure 4: AVO100B-48S1V5 Output Shutdown by Power Off (20ms/div)

Ch 1: CNT (20V/div) Ch 2: Vout(1V/div)

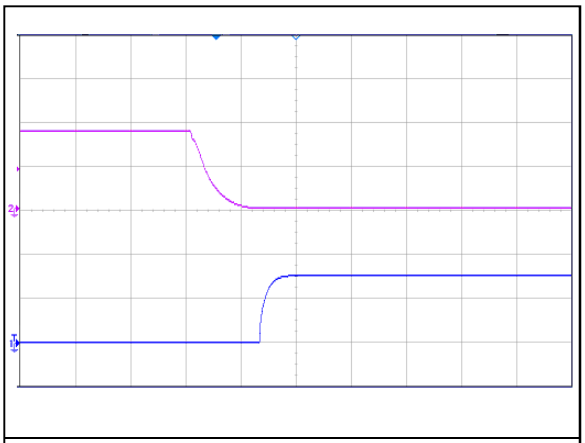


Figure 5: AVO100B-48S1V5 Output Startup by Remote On (20ms/div)

Ch 1: Vout (1V/div) Ch 2: Remote on/off (2V/div)

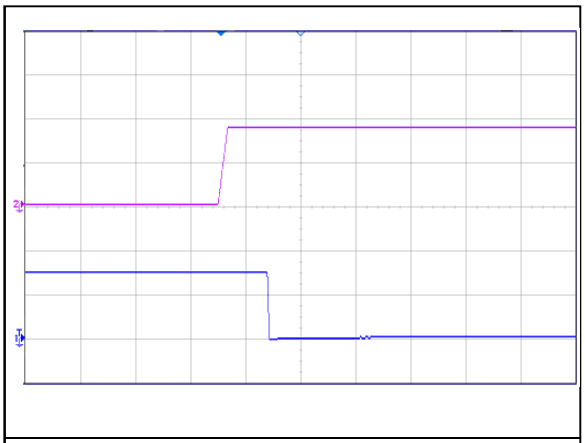


Figure 6: AVO100B-48S1V5 Output Shutdown by Remote Off (20ms/div)

Ch 1: Vout (1V/div) Ch 2: Remote on/off (2V/div)

AVO100B-48S1V5 Performance Curves

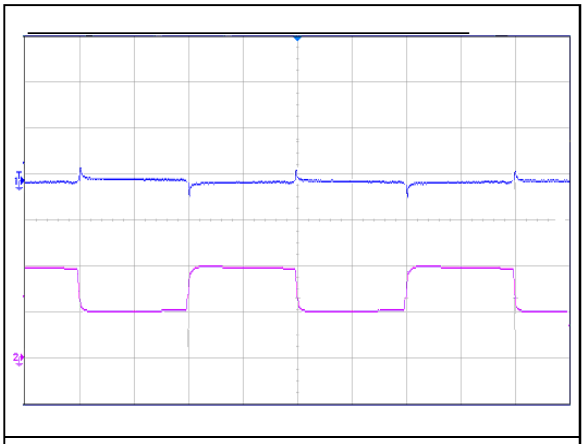


Figure 7: AVO100B-48S1V5 Transient Response (2mS/div)
50%~25%~50% load change, 0.1A/uS slew rate, Vin = 48Vdc
Ch 1: Vo (100mV/div) Ch 2: Io (10A/div)

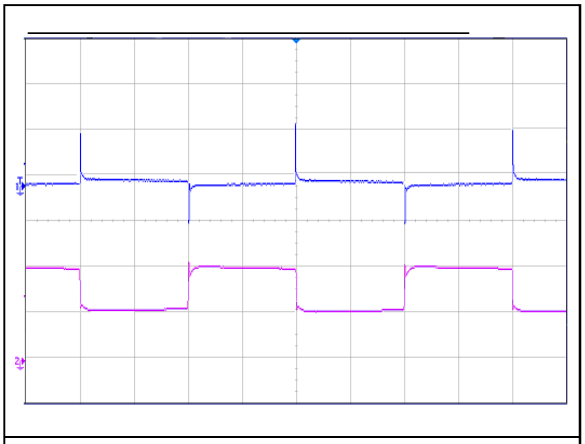


Figure 8: AVO100B-48S1V5 Transient Response (2mS/div)
50%~25%~50% load change, 1A/uS slew rate, Vin = 48Vdc
Ch 1: Vo (100mV/div) Ch 2: Io (10A/div)

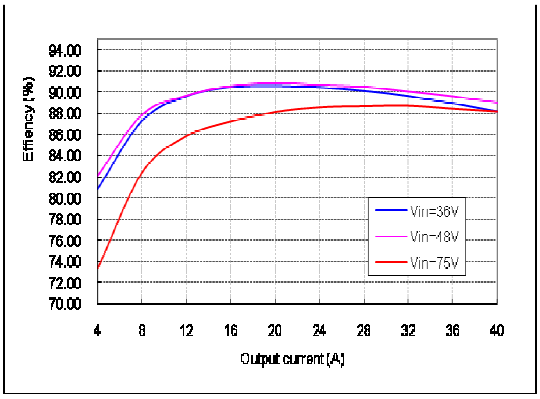


Figure 9: AVO100B-48S1V5 Typical Efficiency
Vin = 36-75Vdc

Protection Function Specification

Input Fusing

The AVO100B-48S1V5 module have no internal fuse. An external fuse must always be employed! To meet international safety requirements, a 250 Volt rated fuse should be used. If one of the input lines is connected to chassis ground, then the fuse must be placed in the other input line.

Standard safety agency regulations require input fusing. Recommended ratings is 10A for the AVO100B-48S1V5 .

Note: The fuse is fast blow type.

Over Voltage Protection (OVP)

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, the module will shut down and then enter a “hiccup mode”. It will auto-restart when over-voltage condition is removed

Over Current Protection (OCP)

AVO100B-48S1V5 DC/DC converters feature current limiting as part of their OCP (Over-current Protection) circuits. When output current exceeds 42A to 47A, the module will shut down and then enter a “hiccup mode”. It will auto-restart when over-current condition is removed

Over Temperature Protection (OTP)

The module 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. OTP test point as below,

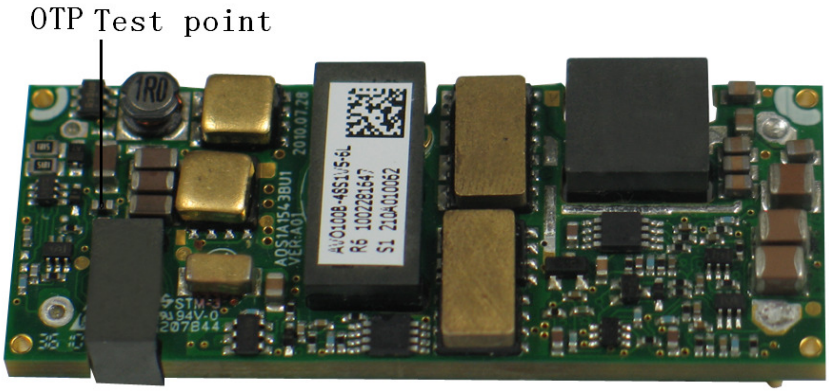


Figure 10 Open Frame Product OTP test poinse

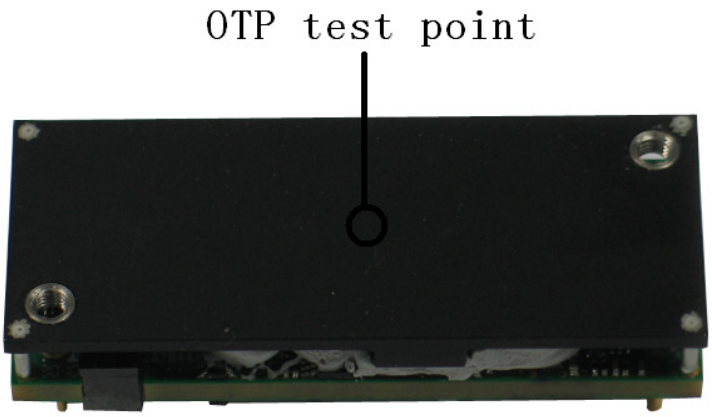
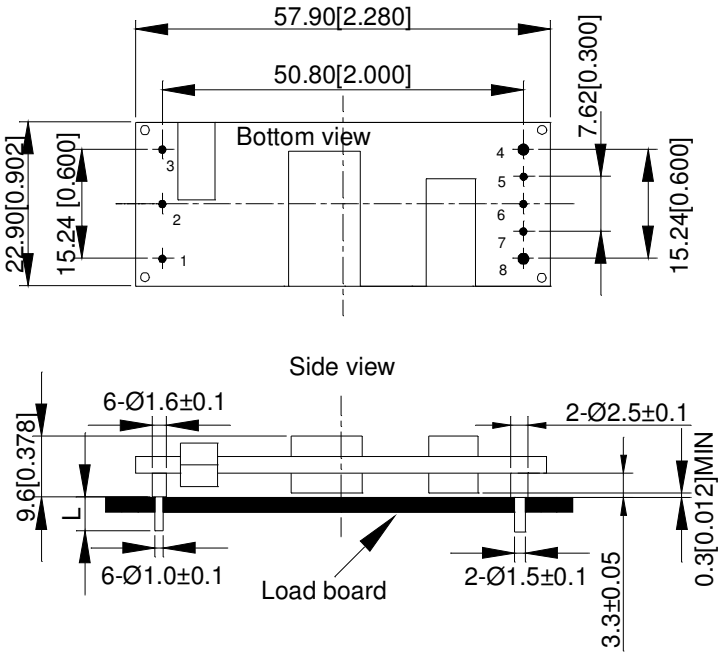


Figure 11 Baseplate Product OTP test poinse

Mechanical Specifications

Mechanical Outlines – Open-Frame Module (Top & Side View)



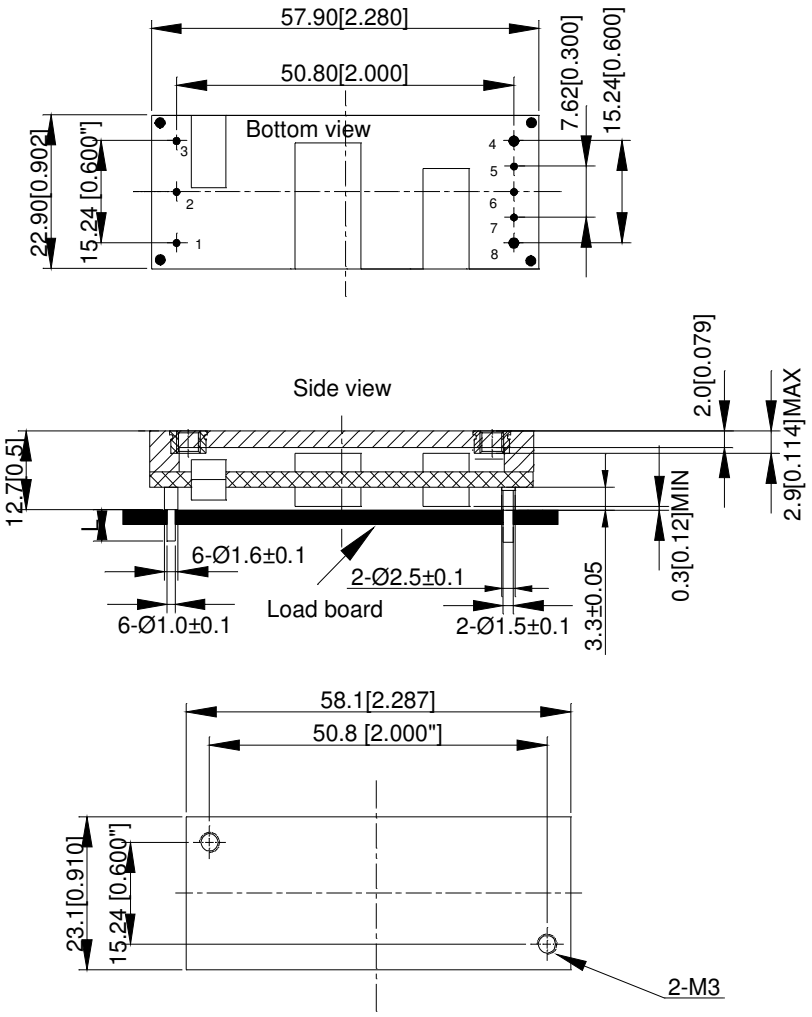
Unit: mm[inch]

Bottom view: pin on upside

Tolerance: X.Xmm±0.5mm[X.X in.±0.02in.]
X.XXmm±0.25mm[X.XX in.±0.01in.]

Figure 12 Open-frame product

Mechanical Outlines – Baseplate Module(Top & Side View)



Unit: mm[inch]

Bottom view: pin on upside

Tolerance: X.Xmm±0.5mm[X.X in.±0.02in.]
X.XXmm±0.25mm[X.XX in.±0.01in.]

Figure 13 Baseplate product

Pin length option

Device code suffix	L
-4	±
-6	±
-8	±
None	±

Pin Designations

Pin No	Name	Function
1	Vin+	Positive input voltage
2	Remote ON/OFF	Remote control
3	Vin-	Negative input voltage
4	Vo-	Positive output voltage
5	S-	Negative remote sense
6	Trim	Output voltage trim
7	S+	Positive remote sense
8	Vo+	Positive output voltage

Environmental Specifications

Electromagnetic compatibility Characteristics

Table 4. Environmental Specifications:

Test Item	Regulations	Criteria
Conducted Emission	EN 55022 DC input port, Class A Limits	/
Immunity to Electrostatic Discharge	IEC/EN6 Enclosure Port, Level 3	B
Immunity to Electrical Fast Transient	IEC/EN6 DC input port, Level 3	B
Immunity to Surges	IEC/EN6 DC input port Line to Ground (earth): 600V Line to Line: 600V	B
Immunity to Continuous Conducted Interference	IEC/EN6 DC input port, Level 2	A
Immunity To Voltage Dips and short interruptions and voltage variations	EN 6 DC input port	B

Criterion A: Normal performance during and after test.
Criterion B: For EFT and surges, low-voltage protection or reset is not allowed. Temporary output voltage fluctuation ceases after disturbances ceases, and from which the EUT recovers its normal performance automatically. For Dips and ESD, output voltage fluctuation or reset is allowed during the test, but recovers to its normal performance automatically after the disturbance ceases.

EMC test conditions

See Figure 21.

Safety Certifications

The AVO100-48S1V8 power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 5. Safety Certifications for AVO100-48S1V8 power supply system

Document	File #	Description
UL/CSA 60950		US and Canada Requirements
EN60950		European Requirements
IEC60950		International Requirements
GB4943		China Requirements
CE		CE Marking

Qualification Testing

Parameter	Unit (pcs)	Test condition
Halt test	4-5	$T_{a,min}$-30 ^{O}C to $T_{a,max}$+25 ^{O}C, 10 ^{O}C step, V_{in} = min to max, 0 ~ 100% load
Vibration	3	Frequency range: 5Hz ~ 20Hz, 20Hz ~ 200Hz, A.S.D: 1.0m^2/s^3, -3db/oct, axes of vibration: X/Y/Z. Time: 30min/axes
Mechanical Shock	3	30g, 6ms, 3axes, 6directions, 3time/direction
Thermal Shock	3	-55 ^{O}C to 125 ^{O}C, unit temperature 20cycles
Thermal Cycling	3	-40 ^{O}C to 85 ^{O}C, temperature change rate: 1^{O}C/min, cycles: 2cycles
Humidity	3	40 ^{O}C, 95%RH, 48h
Solder Ability	15	IPC J-STD-002C-2007

Thermal Considerations – Open Frame

The converter is designed to operate in different thermal environments and sufficient cooling must be provided. Proper cooling of the DC/DC converter can be verified by measuring the temperature at the test points as shown in the figure 14 and figure 15. The temperature at these points should not exceed the max values in Table 1 when the module is operating.

For a typical application, forced airflow direction is from Vin- to Vin+. Figure 16 shows the derating of output current vs. ambient air temperature at different air velocity.

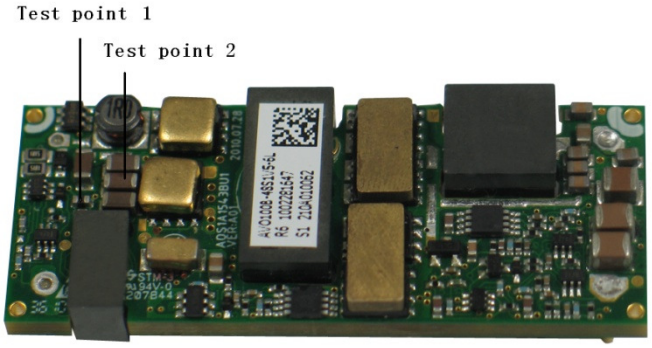


Figure 14 Thermal test points(TOP)

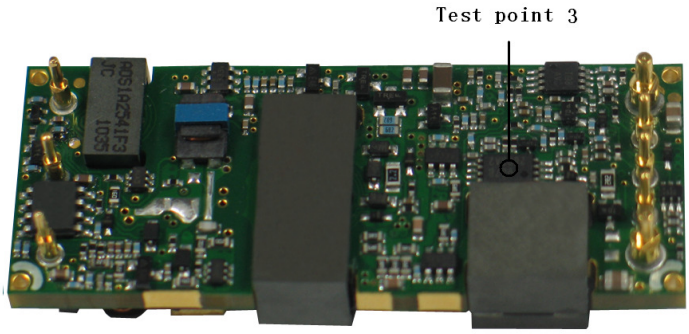


Figure 15 Thermal test points(BOTTOM)

Test Point	Temperature limit
TEST POINT 1	118° C
TEST POINT 2	115° C
TEST POINT 3	115° C

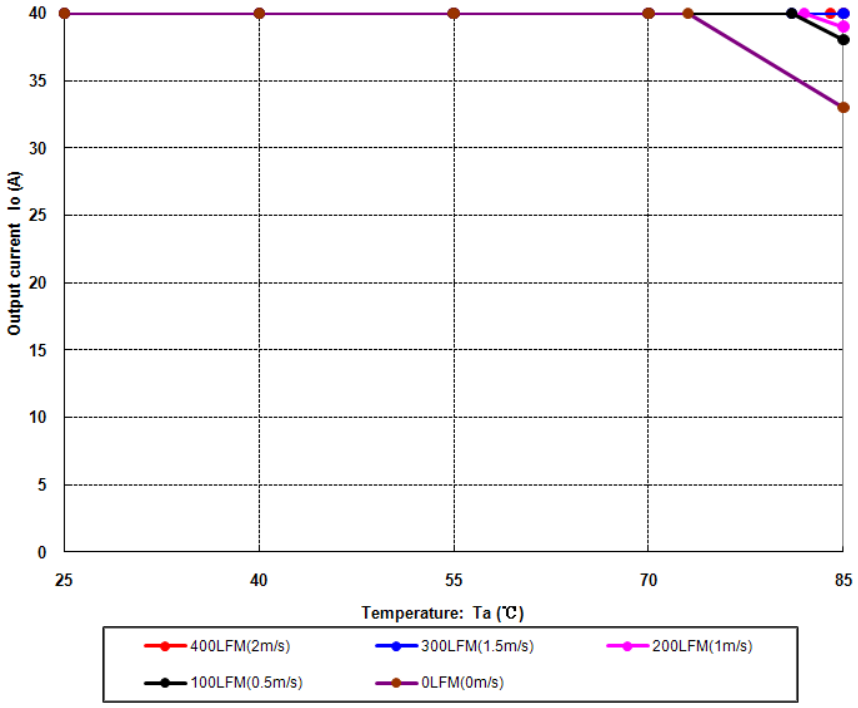


Figure 16 Output power derating, 48Vin, air flowing across the converter from Vin- and Vin+

Thermal Considerations - Baseplate

The converter is designed to operate in different thermal environments and sufficient cooling must be provided. Proper cooling of the DC/DC converter can be verified by measuring the temperature at the test points as shown in the figure 17 and figure 18. The temperature at these points should not exceed the max values in Table 1 when the module is operating.

For a typical application, forced airflow direction is from Vin- to Vin+. Figure 20shows the derating of output current vs. ambient air temperature at different air velocity.

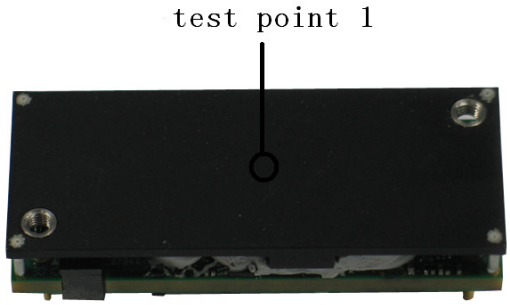


Figure 17 Thermal test points(TOP)

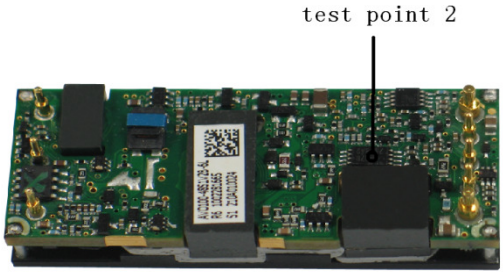


Figure 18 Thermal test points(BOTTOM)

Test Point	Temperature limit
TEST POINT 1	114 ^{O}C
TEST POINT 2	114 ^{O}C

Converter Derating

The converter can operate with a smaller heatsink and sufficient airflow. For a typical application, forced airflow direction is from Vin- to Vin+. Figure 20 shows the derating of output current vs. ambient air temperature at different air velocity with a specified heatsink. The heatsink spec is shown in Figure19.

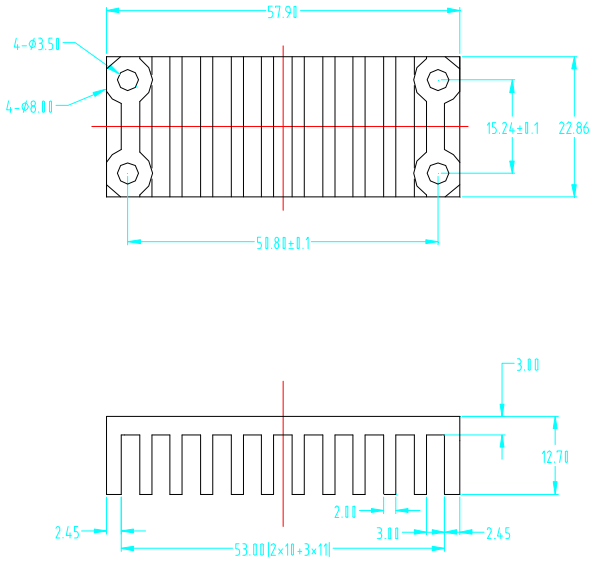


Figure 19 Heatsink

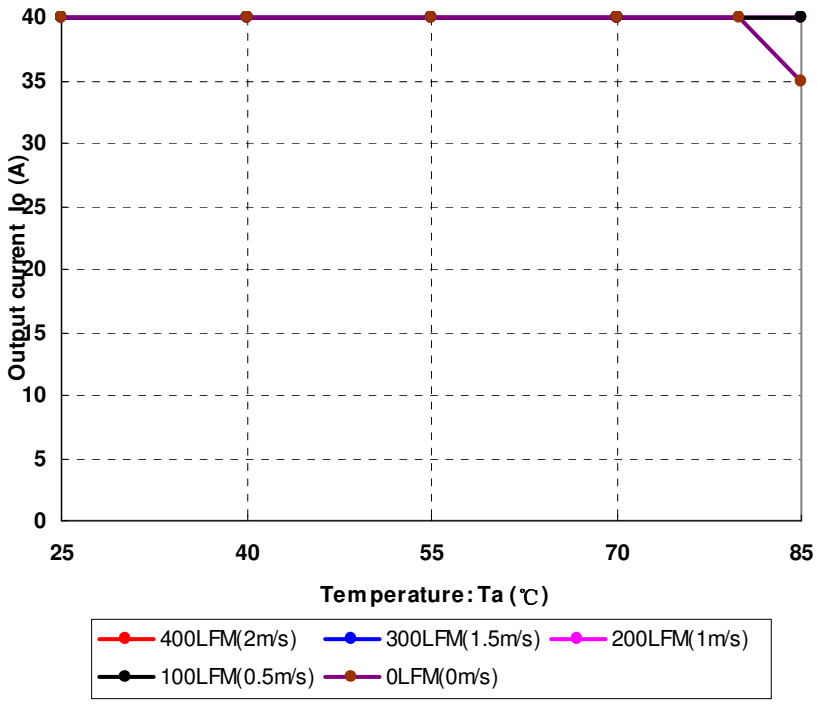


Figure 20 Output power derating, 48Vin, air flowing across the converter from Vin- and Vin+

Application Notes

Typical Application

Below is the typical application of the AVO100B-48S1V5 series power supply.

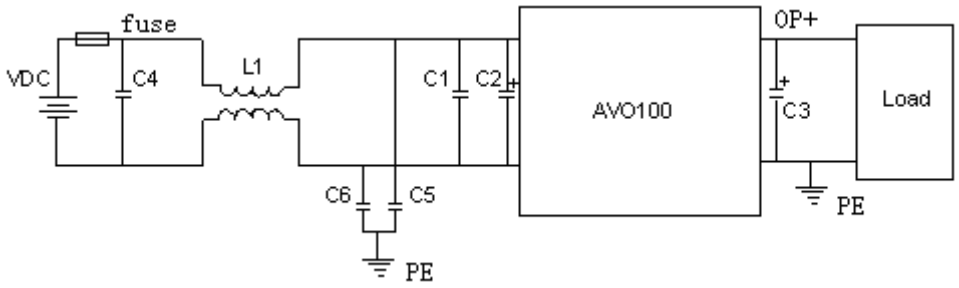


Figure 21 Typical application

Recommended input fuse:Littel fuse 216010.P 10A

C4: SMD ceramic-100V-1000nF-X7R-1210

C1: SMD ceramic-100V-100nF-±10%-X7R-1206

C2: 100μF/100V electrolytic capacitor, high frequency and low ESR

C3: 1000μF/10V electrolytic capacitor, high frequency and low ESR

C5, C6: SMD ceramic- 47nF/1000V/X7R-1210

L1: 1320uH-±25%-4A-R5K-21×21×12.5mm

.

Remote ON/OFF

Either positive or negative remote ON/OFF logic is available in AVO100B-48S1V5B. The logic is CMOS and TTL compatible.

The voltage between pin Remote ON/OFF and pin Vin- must not exceed the range listed in table “Feature characteristics” to ensure proper operation. The external Remote ON/OFF circuit in AVO100B-48S1V5B is highly recommended as shown in figure 22.

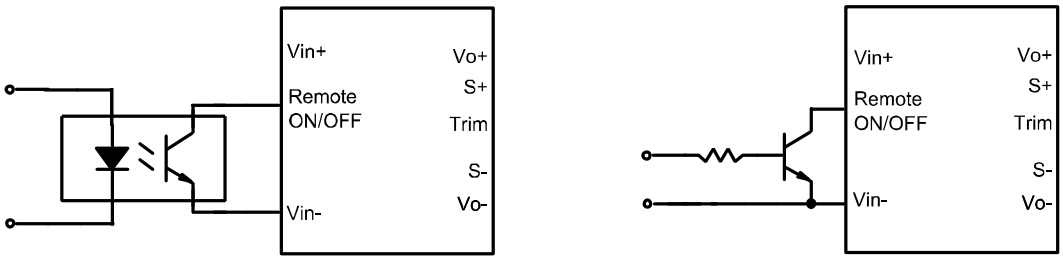


Figure 22 external Remote ON/OFF circuit

Trim Characteristics

Connecting an external resistor between Trim pin and Vo- pin will decrease the output voltage. While connecting it between Trim and Vo+ will increase the output voltage. The following equations determine the external resistance to obtain the trimmed output voltage.

$$R_{adj\_down} = (\frac{511}{\Delta\%} - 10.22)k\Omega$$

$$R_{adj\_up} = (\frac{5.11 V_{out}(100+\Delta\%)}{V_{ref}\ \Delta\%} - \frac{511}{\Delta\%} - 10.22)k\Omega$$

R_{adj_down} :Value of external adjustment resistor which shall be connected between Trim and –Sense for trimming down.

$\Delta\%$ Output voltage change rate against nominal output voltage.

R_{adj_up} :Value of external adjustment resistor which shall be connected between Trim and +Sense for trimming up.

Vout: Nominal output voltage.

Vref = 1.225 V

When trimming up, the output current should be decreased accordingly so as not to exceed the maximum output power as shown in below figure.

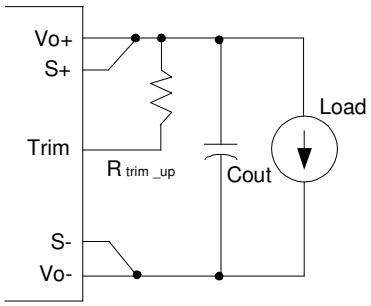


Figure 23 Trim up

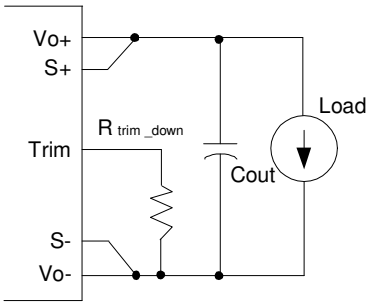


Figure 24 Trim down

Input Ripple & Inrush Current and Output Ripple & Noise Test Configuration

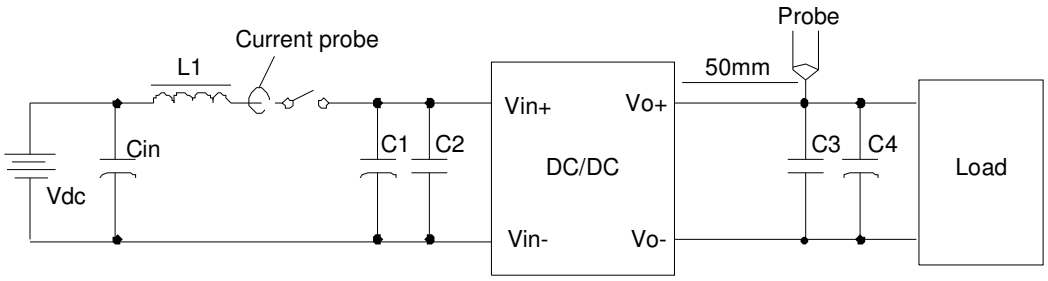


Figure 25 Input ripple & inrush current ,output ripple & noise test configuration

Vdc: DC power supply

L1: 12μH

Cin: 220μF/100V typical

C1: SMD ceramic-100V-100nF-±10%-X7R-1206

C2: 100μF/100V electrolytic capacitor, high frequency and low ESR

C3: SMD ceramic-10V-1μF-±10%-X7R-1206

C4: 1000μF/10V electrolytic capacitor, high frequency and low ESR

Note: Using a coaxial cable with series 50Ω resistor and 0.68μF ceramic capacitor or a ground ring of probe to test output ripple & noise is recommended.

Sense Characteristics

If the load is far from the unit, connect S+ and S- to the terminal of the load respectively to compensate the voltage drop on the transmission line.

If the sense compensate function is not necessary, connect S+ to Vo+ and S- to Vo- directly.

Soldering

For R6 product, it is intended for standard manual or wave soldering.

When wave soldering is used, the temperature on pins is specified to maximum 260° C for maximum 7s.

When soldering by hand, the iron temperature should be maintained at 300° C ~ 380° C and applied to the converter pins for less than 10s. Longer exposure can cause internal damage to the converter.

Cleaning of solder joint can be performed with cleaning solvent IPA or similative.

For R5 product , it is intended for standard manual or wave soldering.

When wave soldering is used, the temperature on pins is specified to maximum 255° C for maximum 7s.

When soldering by hand, the iron temperature should be maintained at 300° C ~ 380° C and applied to the converter pins for less than 10s. Longer exposure can cause internal damage to the converter.

Cleaning of solder joint can be performed with cleaning solvent IPA or similative.

Assembly

The maximum length of the screw driven into the heat-sink is 3.3mm.

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Hazardous Substances Announcement (RoHS of China)

Parts	Hazardous Substances					
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
AVO100B-48S1V5 series	x	x	x	x	x	x

x: Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006

√: Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006

Artesyn Embedded Technologies has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the hazardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain hazardous substances due to the lack of reliable substitute or mature solution:

1. Solders (including high-temperature solder in parts) contain plumbum.
2. Glass of electric parts contains plumbum.
3. Copper alloy of pins contains plumbum