AVO100B-48S3V3

100 Watts

Eighth-brick Converter

Total Power: 100 Watts
Input Voltage: 36 to 75 Vdc
# of Outputs: Single

Special Features

- Delivers up to 30A output current
- Industry standard eighth brick foot print 57.9mm x 22.9mm x 8.9mm (2.28" x 0.9" x 0.35")
- No minimum load requirement
- Ultra high efficiency: 92.5%
- Excellent thermal performance
- High power density
- Low output noise
- 2:1 wide input voltage of 36V-75V
- Remote control function (negative or positive logic optional)
- Remote sense
- Trim function: +10%/-20%
- Input under-voltage lockout
- Output over-current protection
- Output over-voltage protection
- Over-temperature protection
- RoHS compliant

Safety

IEC/EN/UL/CSA 60950
CE Mark
UL/TUV

Product Descriptions

The AVO100B-48S3V3 is a single output DC/DC converter with standard eighth-brick form factor and pin configuration. It delivers up to 30A output current with 3.3V output. Ultra-high 92.5% efficiency and excellent thermal performance makes it an ideal choice for small space, high current and low voltage 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 Status
AVO100B-48S3V3-6L	3.3Vdc	Open-frame	Negative	R6
AVO100B-48S3V3P-6L	3.3Vdc	Open-frame	Positive	R6
AVO100B-48S3V3-4L	3.3Vdc	Open-frame	Negative	R6
AVO100B-48S3V3PB-6L	3.3Vdc	Baseplate	Positive	R6
AVO100B-48S3V3SL	3.3Vdc	Open-frame	Negative	R6

Ordering information

AVO100B	-	48	S	3V3	P	B	-	6	L
①		②	③	④	⑤	⑥		⑦	⑧

①	Model series	AVO: high efficiency eighth brick series, 100B: output power 100W
②	Input voltage	48: 36V ~ 75V input range, rated input voltage 48V
③	Output number	S: single output
④	Rated output voltage	3V3: 3.3V output
⑤	Remote ON/OFF logic	Default: negative logic; P: positive logic
⑥	Baseplate	B: with baseplate; default: open frame
⑦	Pin length	Omit for 5.8mm±0.25mm 4: 4.8mm±0.25mm 6: 3.8mm±0.25mm 8: 2.8mm±0.25mm S: SMT pin
⑧	RoHS status	L: RoHS, R6

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 Modules	$V_{IN,DC}$	0	-	80	Vdc
Non-operating -100mS	All Modules		0	-	100	Vdc
Maximum Output Power	All Modules	$P_{O,max}$	0	-	100	W
Isolation Voltage[1]						
Input to outputs	All Modules		2000	-	-	Vdc
Isolation Resistance	All Modules	R	10			Mohm
Ambient Operating Temperature	All Modules	T_A	-40	-	+85	^{O}C
Storage Temperature	All Modules	T_{STG}	-55	-	+125	^{O}C
Voltage at remote ON/OFF pin	All Modules		-0.7	-	12	Vdc
Humidity (non-condensing)						
Operating	All Modules		-	-	95	%
Non-operating	All Modules		-	-	95	%

Note 1 - 1mA for 60s, 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	33.5	36	Vdc
Turn-off Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,OFF}$	30	31.5	35	Vdc
Lockout Voltage Hysteresis	$I_O = I_{O,max}$		1	2	3	V
Maximum Input Current ($I_O = I_{O,max}$)	$V_{IN,DC} = 36V_{DC}$	$I_{IN,max}$	-	3.05	3.5	A
No Load Input Current (V_O On, I_O = 0A, I_{VSB} = 0A)	$V_{IN,DC} = 36V_{DC}$	I_{IN,no_load}	-	-	0.1	A
Standby Input Current	$V_{IN,DC} = 36V_{DC}$ Remote OFF	$I_{IN,standby}$	-	0.01	0.1	A
Inrush Current Transient Rating			-	0.5	1	A^2S
Input filter component values (C\L)			-	2\3	-	µF\µH
Recommended Input Fuse	Fast blow external fuse recommended		-	-	6.3	A
Recommended External Input Capacitance	Low ESR capacitor recommended	C_{IN}	-	100	-	uF
Input Reflected Ripple Current	Through 12uH inductor		-	10	30	mAp-p
Operating Efficiency	T_A=25 °C $I_O = I_{O,max}$ $I_O = 50\%I_{O,max}$	η	- -	92 92.5	- -	% %

Output Specifications

Table 3. Output Specifications:

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Factory Set Voltage		$V_{IN,DC}$ = 48V_{DC} I_O=$I_{O,max}$	V_O	3.25	3.3	3.35	Vdc
Total Regulation		Inclusive of line, load temperature change, warm-up drift	V_O	3.2	3.3	3.4	Vdc
Output Voltage Line Regulation		$V_{IN,min}$ to $V_{IN,max}$	%V_O	-	0.1	0.24	%
Output Voltage Load Regulation		$I_{O,min}$ to $I_{O,max}$	%V_O	-	0.15	0.45	%
Output Voltage Temperature Regulation		All	%V_O	-	0.002	0.02	%/^{O}C
Output Voltage Trim Range		All	V_O	2.64	-	3.63	V
Output Ripple, pk-pk		Measure with a 1uF ceramic capacitor in parallel with a 10uF tantalum capacitor, 0 to 20MHz bandwidth	V_O	-	40	120	mV_{PK-PK}
Output Current		All	I_O	0	-	30	A
Output DC current-limit inception[1]			I_O	33	-	42	A
V_O Load Capacitance[2]		All	C_O	220	-	10000	uF
V_O Dynamic Response	Peak Deviation	50%~75%~50% 25% load change slew rate = 0.1A/us	±V_O	-	60	-	mV
	Settling Time		T_s	-	70	-	uSec
	Peak Deviation	50%~75%~50% 25% load change slew rate = 1A/us	±V_O	-	150	-	mV
	Settling Time		T_s	-	80	-	uSec
Turn-on transient	Rise time	I_O = I_{max}	T_{rise}	-	3	30	mS
	Turn-on delay time	I_O = I_{max}	$T_{turn-on}$	-	5	10	mS
	Output voltage overshoot	I_O = $I_{O,max}$	%V_O	-	-	5	%
Switching frequency		All	f_{SW}	-	310	-	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

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
Output over-voltage protection[3]	All	$\%V_{O, nom}$	115	130	150	%
Output over-temperature protection[4]	All	T	120	130	140	^{O}C
Over-temperature hysteresis	All	T	5	20	-	^{O}C
Output voltage remote sense range	All	Vo	-	-	0.33	V
Calculated MTBF	Telcordia SR-332-2006; 80% load; 300LFM, 25 ^{O}C T_A		-	2.5	-	10^6 h
Weight			34.5		46.5	g

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

AVO100B-48S3V3 Performance Curves

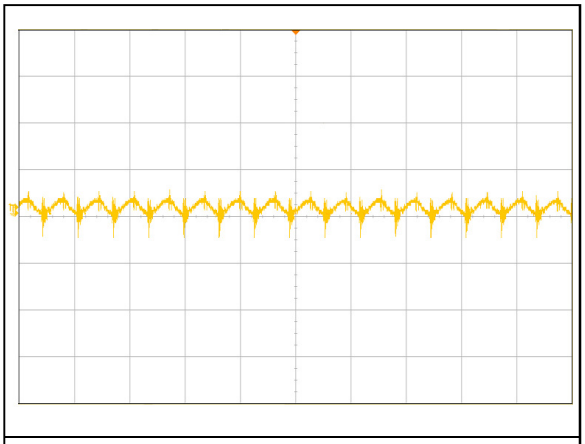


Figure 1: AVO100B-48S3V3 Input Reflected Ripple Current Waveform

Ch 1: Iin (5uS/div, 5mA/div)

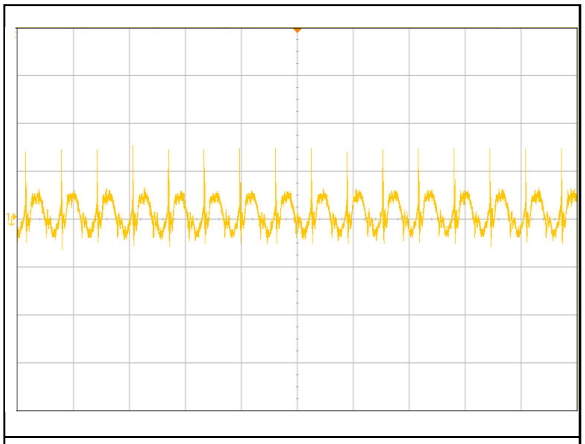


Figure 2: AVO100B-48S3V3 Ripple and Noise Measurement

Ch 1: Vo (5us/div, 20mV/div)

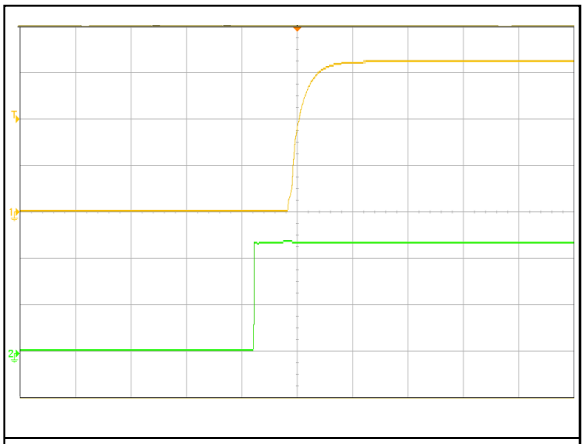


Figure 3: AVO100B-48S3V3 Output Voltage Startup Characteristic
50ms/div

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

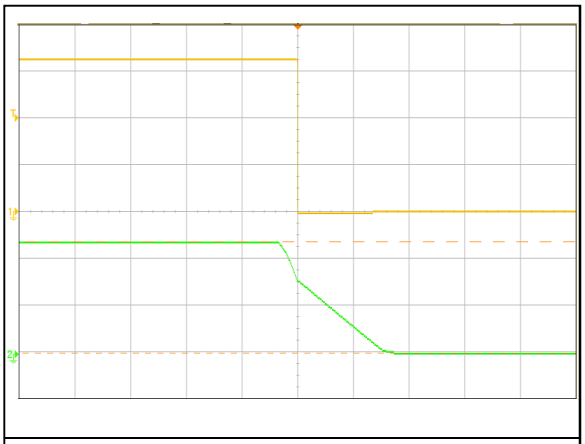


Figure 4: AVO100B-48S3V3 Output Voltage Turn Off Characteristic
50ms/div

Ch 1: Vo (1V/div) Ch 2: Vin (5V/div)

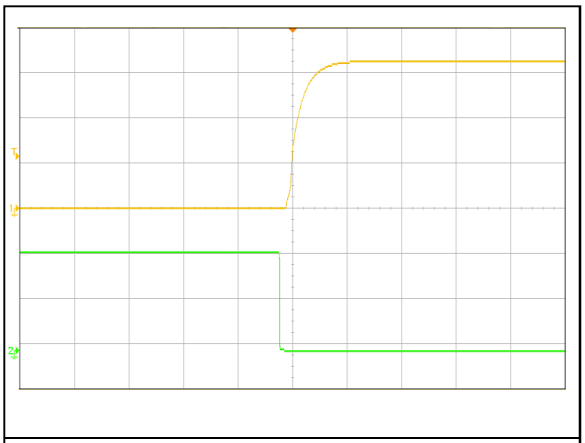


Figure 5: AVO100B-48S3V3 Remote ON Waveform (5mS/div)
Negative logic

Ch 1: Vo (1V/div) Ch 2: Remote ON (2V/div)

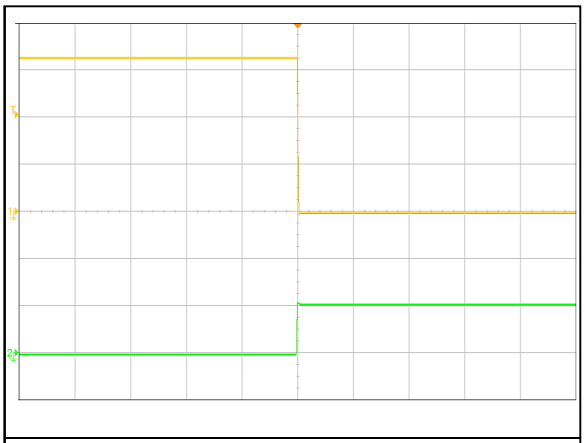


Figure 6: AVO100B-48S3V3 Remote OFF Waveform (1mS/div)
Negative logic

Ch 1: Vo (1V/div) CH2: Remote OFF (5V/div)

AVO100B-48S3V3 Performance Curves

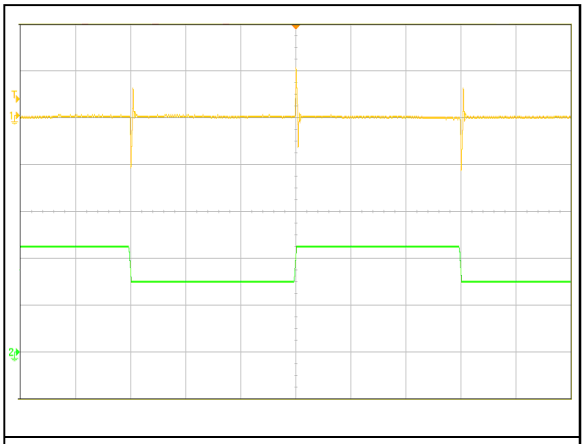


Figure 7: AVO100B-48S3V3 Transient Response (2mS/div)
50%~75%~50% load change, 0.1A/uS slew rate, Vin=48V
Ch 1: Vo (50mV/div) Ch 2: Io (10A/div)

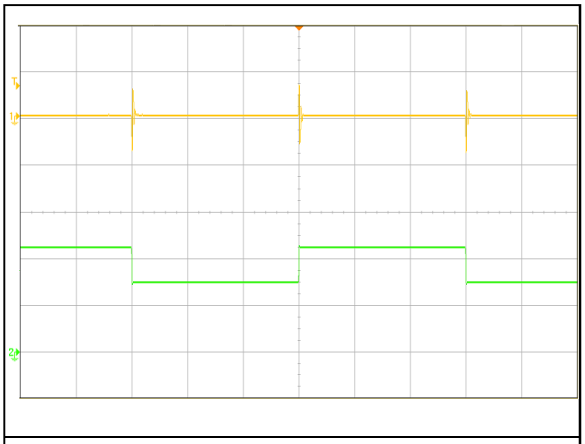


Figure 8: AVO100B-48S3V3 Transient Response (2mS/div)
50%~75%~50% load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo (200mV/div) Ch 2: Io (10A/div)

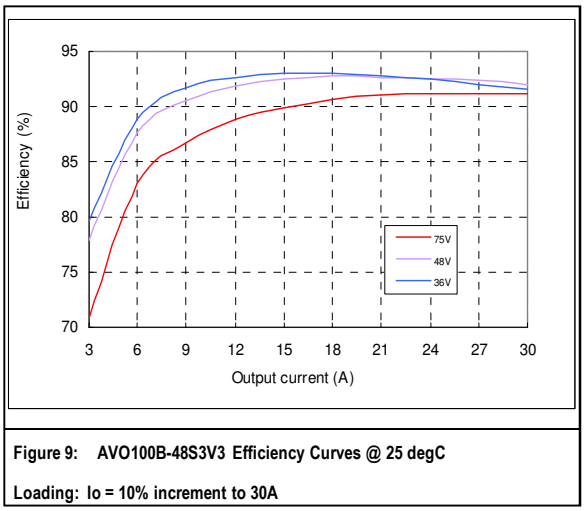


Figure 9: AVO100B-48S3V3 Efficiency Curves @ 25 degC
Loading: Io = 10% increment to 30A

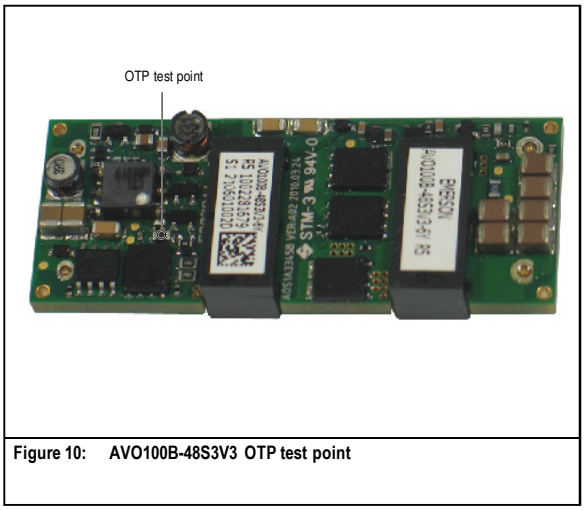


Figure 10: AVO100B-48S3V3 OTP test point

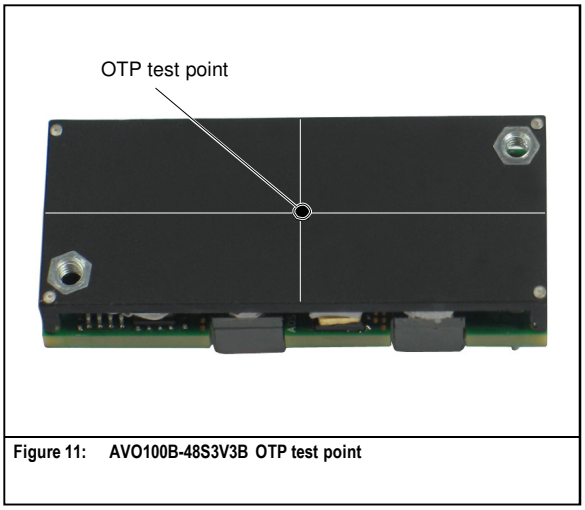
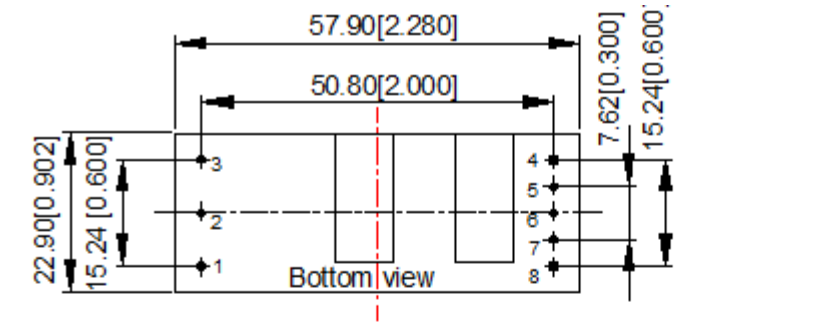
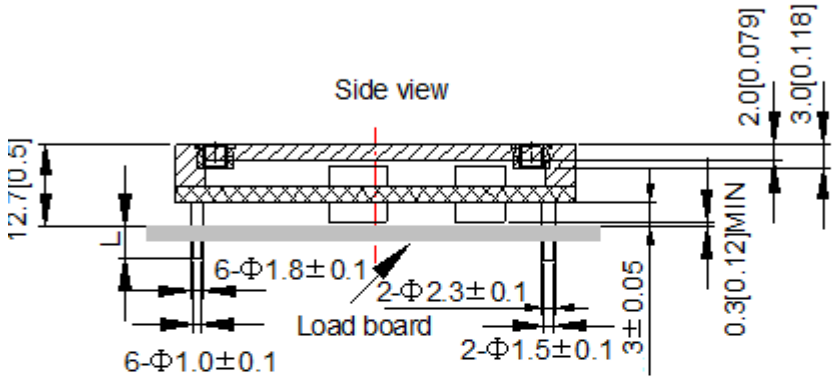


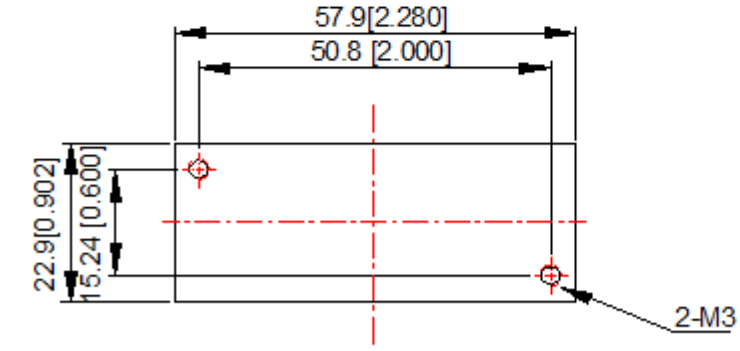
Figure 11: AVO100B-48S3V3B OTP test point

Mechanical Specifications

Mechanical Outlines - Open frame







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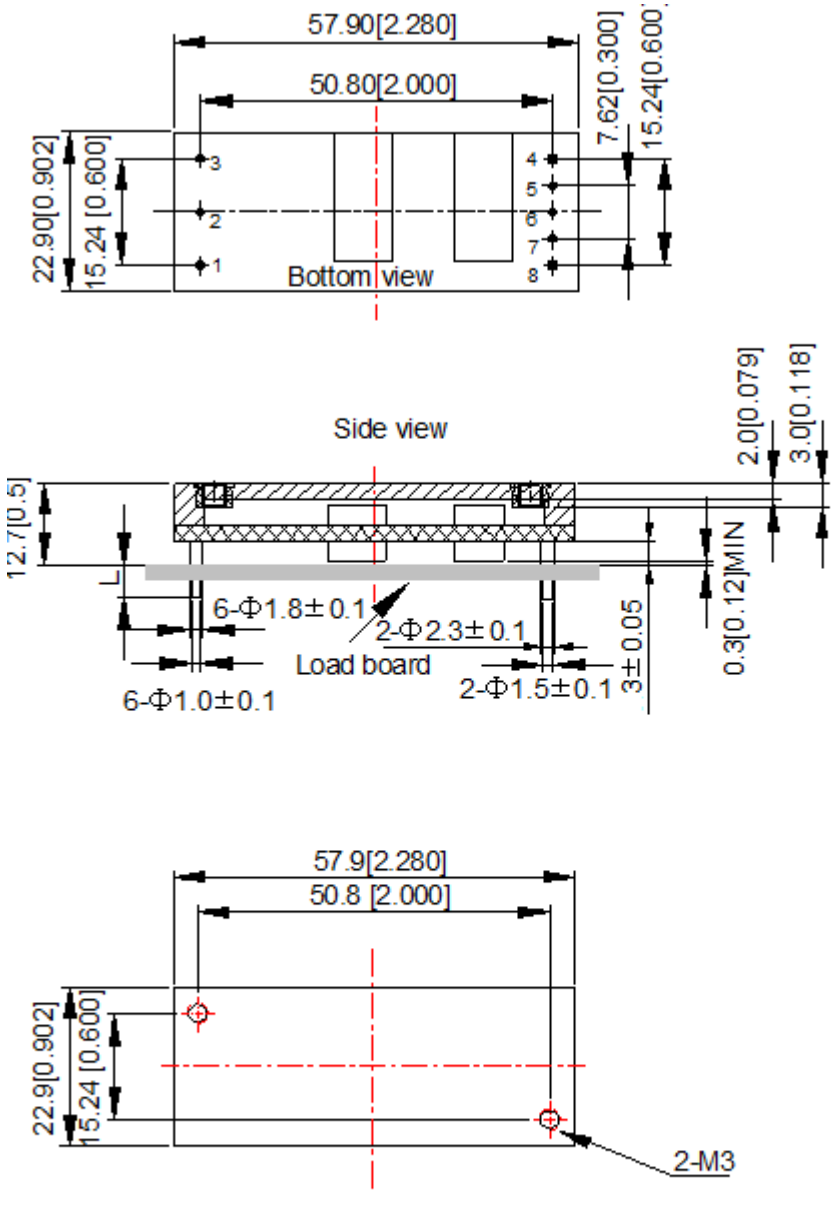
Unit: mm[inch] Bottom view: pin on upside

Tolerance: X.Xmm ±0.5mm[X.X in. ± 0.02in.]

X.XXmm ±0.25mm[X.XX in. ± 0.01in.]

Mechanical Specifications

Mechanical Outlines - Baseplate



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Unit: mm[inch]

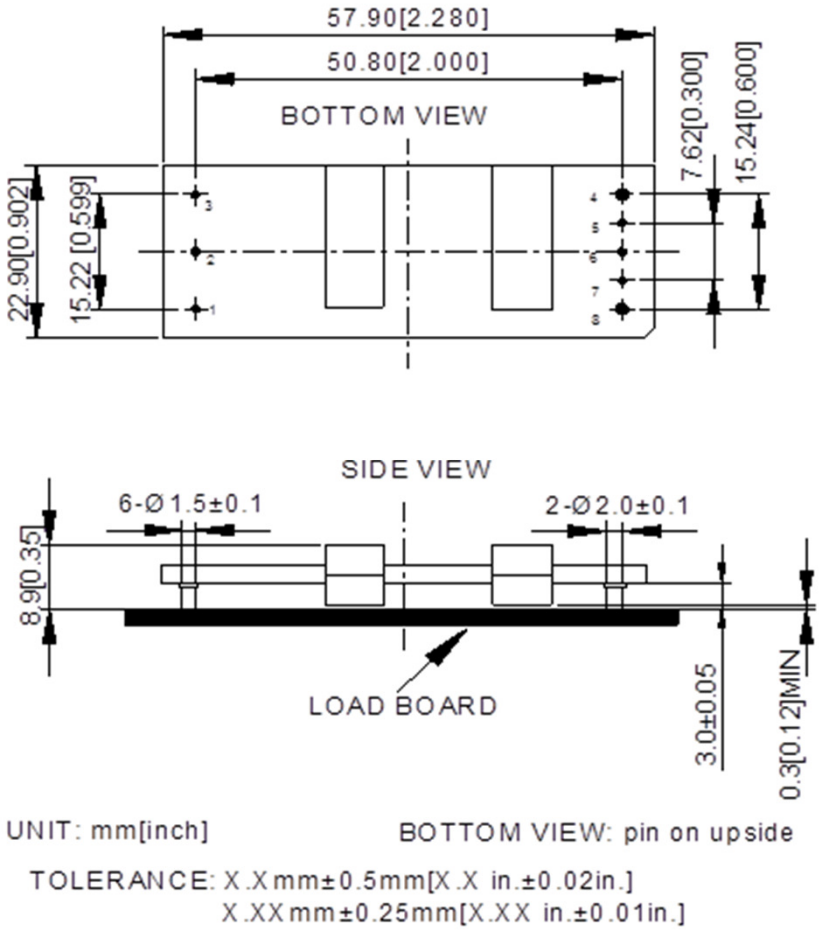
Bottom view: pin on upside

Tolerance: X.Xmm ±0.5mm[X.X in. ± 0.02in.]

X.XXmm ±0.25mm[X.XX in. ± 0.01in.]

Mechanical Specifications

Mechanical Outlines – SMT Module



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Pin Length Option

Device code suffix	L
-4	4.8mm±0.25 mm
-6	3.8mm±0.25 mm
-8	2.8mm±0.25 mm
None	5.8mm±0.25 mm

Pin Designations

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

Environmental Specifications

EMC Immunity

AVO100B-48S3V3 power supply is designed to meet the following EMC immunity specifications:

Table 4. Environmental Specifications:

Document	Description	Criteria
EN55022, Class A Limits	Conducted and Radiated EMI Limits	/
IEC/EN 61000-4-2, Level 3	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Electrostatic discharge immunity test. Enclosure Port	B
IEC/EN 61000-4-6, Level 2	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Continuous Conducted Interference. DC input port	A
IEC/EN 61000-4-4, Level3	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Electrical Fast Transient. DC input port.	B
IEC/EN 61000-4-5	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Immunity to surges - 600V common mode and 600V differential mode for DC ports	B
EN61000-4-29	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Voltage Dips and short interruptions and voltage variations. 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.

Criterion C: Temporary loss of output, the correction of which requires operator intervention.

Criterion D: Loss of output which is not recoverable, owing to damage to hardware.

Recommend EMC Filter Configuration

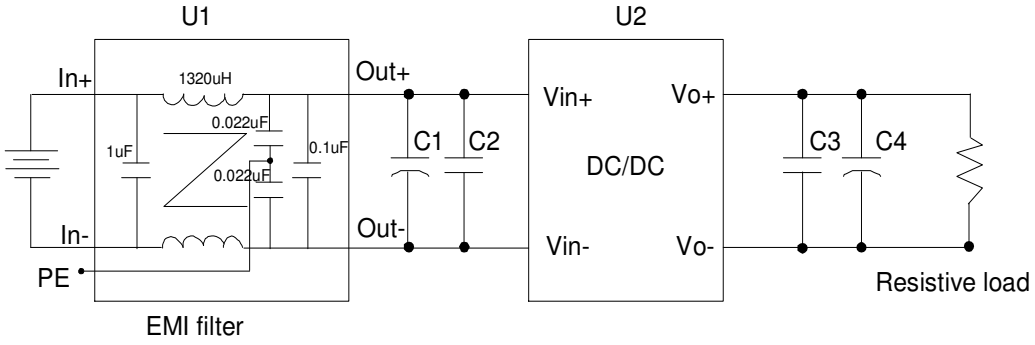

Figure 12 EMC test configuration

U1: Input EMC filter

U2: Module to test, AVO100B-48S3V3

C1 ~ C4: See Figure 20

Safety Certifications

The AVO100B-48S3V3 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 AVO100B-48S3V3 power supply system

Document	File #	Description
UL/CSA 60950		US and Canada Requirements
EN60950		European Requirements
IEC60950		International Requirements
CSA60950		International Requirements
UL94		V-0 flammability rating
CE		CE Marking

Operating Temperature

The AVO100B-48S3V3 power supplies will start and operate within stated specifications at an ambient temperature from -40 ^{O}C to 85 ^{O}C under all load conditions. The storage temperature is -55 ^{O}C to 125 ^{O}C.

Thermal Considerations - Open frame

The converter is designed to operate in different thermal environments and sufficient cooling must be provided. Proper cooling can be verified by measuring the temperature at the test points. The temperature at these test points should not exceed the maximum values in Table 6.

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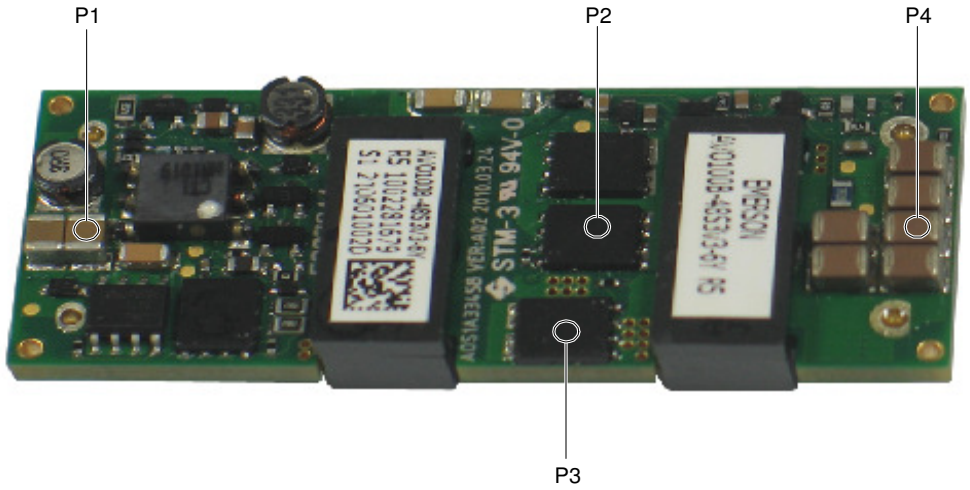

Figure 13 Temperature test point

Table 6. Temperature limit of the test point

Test Point	Temperature Limit
P1	118 ^{O}C
P2	130 ^{O}C
P3	130 ^{O}C
P4	118 ^{O}C

For a typical application, Figure 14 shows the derating of output current vs. ambient air temperature at different air velocity. Figure 15 shows the thermal image taken by a RF camera at a rated I/O condition.

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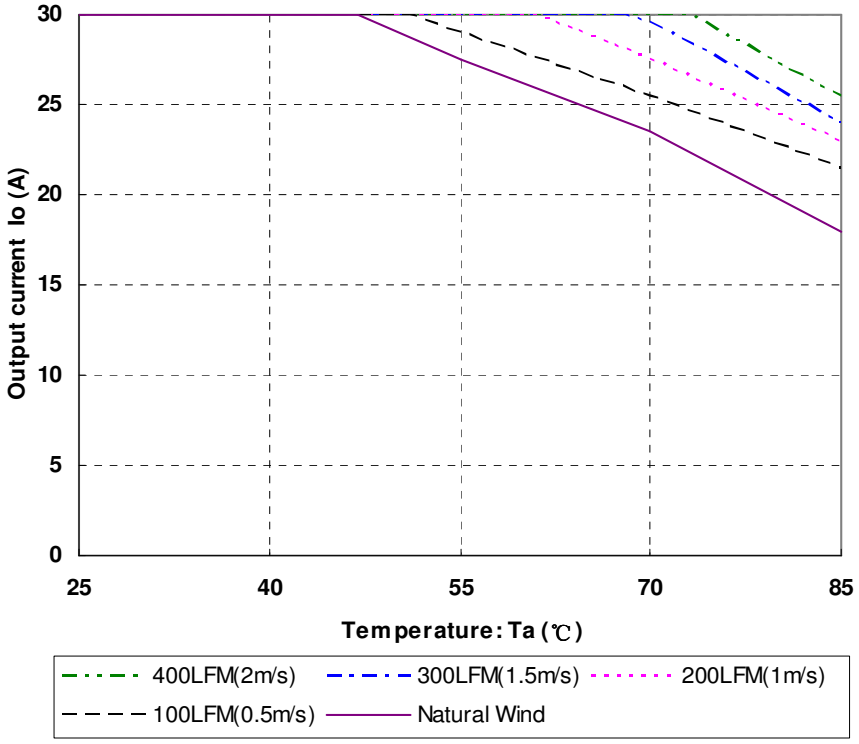

Figure 14 Output power derating, 48V_{in}, air flowing across the converter from pin 3 to pin 1

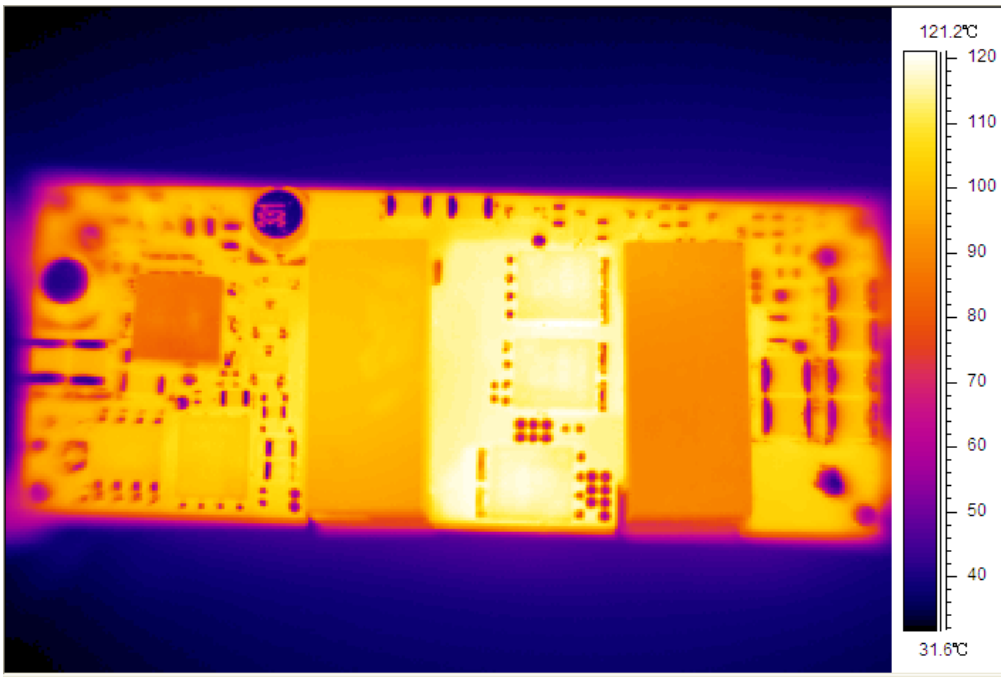

Figure 15 Thermal image, 48V_{in}, 3.3V_o, full load, room temperature, 100LFM (air flowing from pin 3 to pin 1)

Thermal Considerations - Baseplate

The converter is designed to operate in different thermal environments and sufficient cooling must be provided. Proper cooling can be verified by measuring the temperature at the test points. The temperature at these test points should not exceed the maximum values in Table 7.

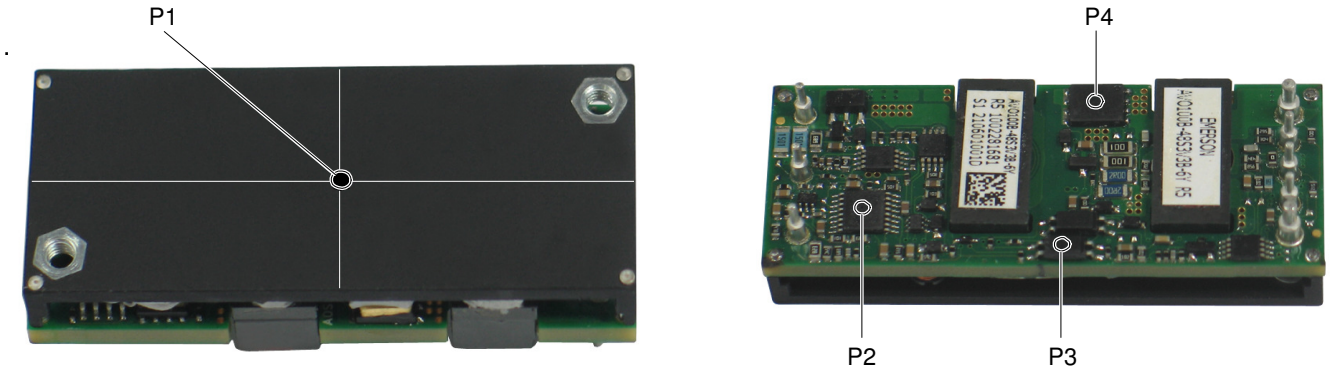

Figure 16 Temperature test point

Table 7. Temperature limit of the test point

Test Point	Temperature Limit
P1	110 ^{O}C
P2	122 ^{O}C
P3	118 ^{O}C
P4	127 ^{O}C

The converter can operate with a smaller heatsink and sufficient airflow. The typical test condition is shown in Figure 17.

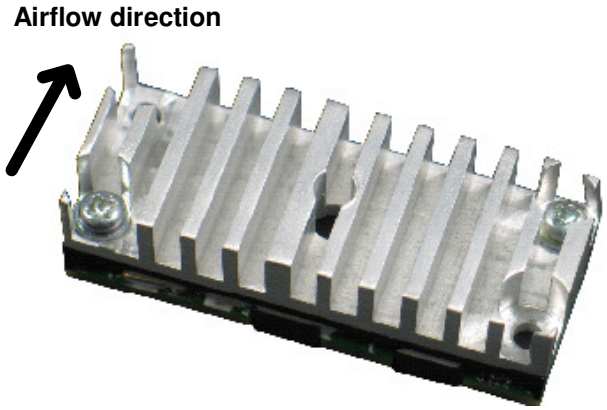

Figure 17 Typical test condition, heatsink size (L*W*H): 57.9mm * 22.86mm * 6.3mm

For a typical application, Figure 18 shows the derating of output current vs. ambient air temperature at different air velocity with a specified heatsink. Figure 19 shows the thermal image taken by a RF camera at a rated I/O condition.

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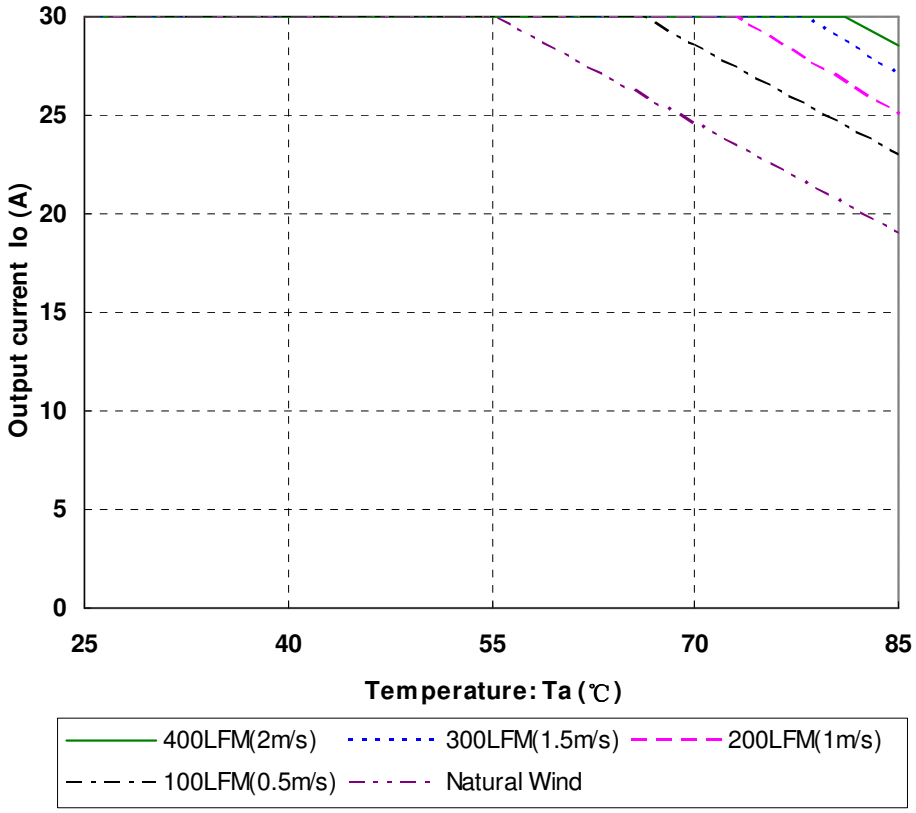

Figure 18 Output power derating, $48V_{in}$, air flowing across the converter from pin 3 to pin 1

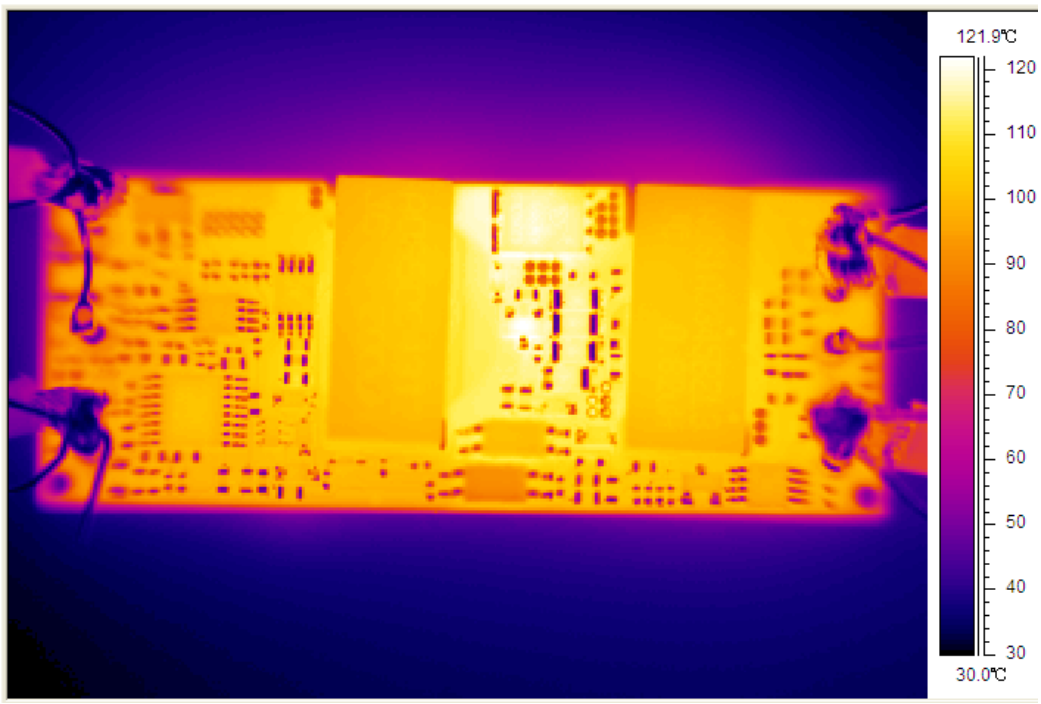

Figure 19 Thermal image, $48V_{in}$, $3.3V_o$, full load, room temperature, 100LFM (air flowing from pin 3 to pin 1)

Qualification Testing

Parameter	Unit (pcs)	Test condition
Halt test	4-5	$T_{a,min}$-10 ^{O}C to $T_{a,max}$+10 ^{O}C, 5 ^{O}C step, V_{in} = min to max, 0 ~ 105% 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/axis
Mechanical Shock	3	30g, 6ms, 3axes, 6directions, 3time/direction
Thermal Shock	3	-40 ^{O}C to 100 ^{O}C, unit temperature 20cycles
Thermal Cycling	3	-40 ^{O}C to 55 ^{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

Application Notes

Typical Application

Below is the typical application of the AVO100B-48S3V3 power supply.

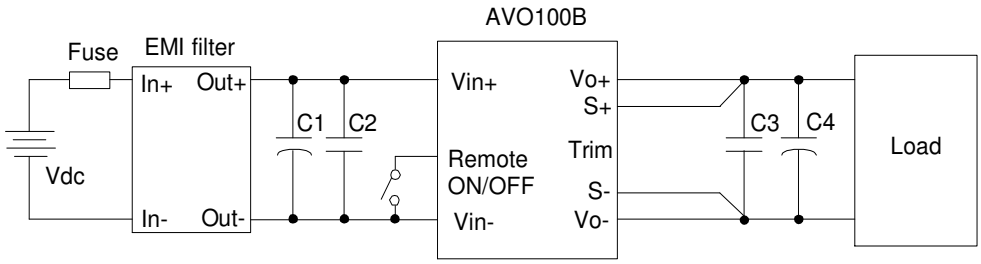

Figure 20 Typical application

C1: 100μF/100V electrolytic capacitor, P/N: UPM2A101MPD (Nichicon) or equivalent caps

C2, C3: 1μF/100V X7R ceramic capacitor, P/N: C3225X7R2A105KT0L0U (TDK) or equivalent caps

C4: 220μF/25V electrolytic capacitor, P/N: UPM1E221MED (Nichicon) or equivalent caps

Note: If ambient temperature is below -5^{O}C, additional 220μF tantalum capacitor (Low ESR, ESR≤100mΩ) is needed for output.

Fuse: External fast blow fuse with a rating of 6.3A/250Vac. The recommended fuse model is GDA-V-6.3A from Cooper Bussmann Inc.

Remote ON/OFF

Either positive or negative remote ON/OFF logic is available in AVO100B-48S3V3. The logic is CMOS and TTL compatible.

Below is the detailed internal circuit and reference in AVO100B-48S3V3.

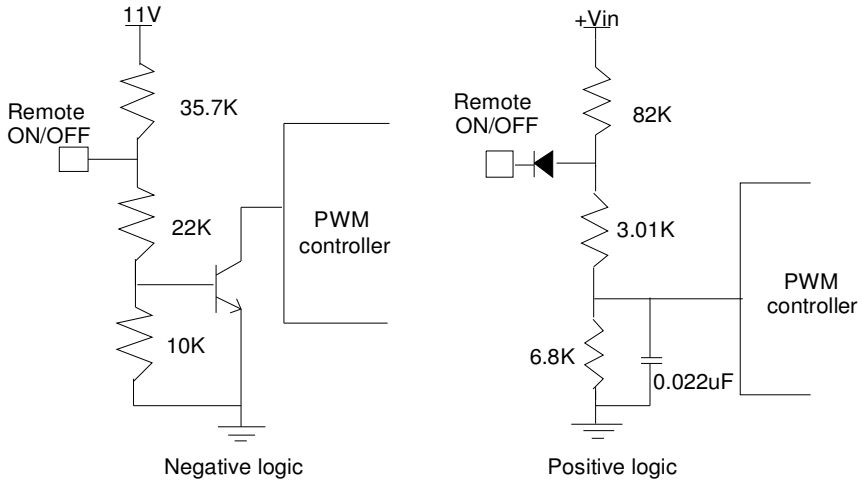

Figure 21 Remote ON/OFF internal diagram

The voltage between pin Remote ON/OFF and pin Vin- must not exceed the range listed in table “Output Specifications” to ensure proper operation. The external remote ON/OFF circuit is highly recommended as shown in Figure 22.

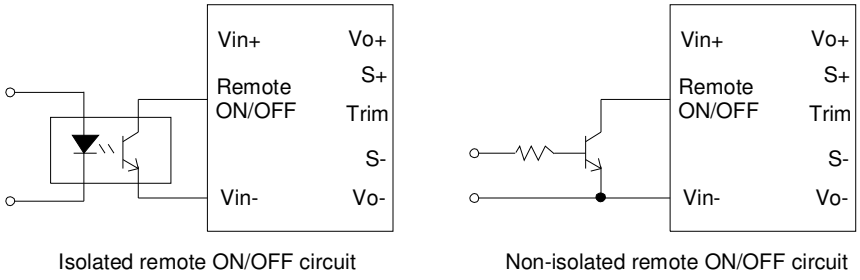

Figure 22 External Remote ON/OFF circuit

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.

$$R_{adj-down} = \frac{510}{\Delta} - 10.2(K\Omega)$$

$$R_{adj-up} = \frac{5.1 \times V_{nom} \times (100+\Delta)}{1.225 \times \Delta} - \frac{510}{\Delta} - 10.2(K\Omega)$$

△: Output e rate against nominal output voltage.

$$\Delta = \frac{100 \times (V_{nom} - V_0)}{V_{nom}}$$

V_{nom}: Nominal output voltage

For example, to get 3.63V output, the trimming resistor is

$$\Delta = \frac{100 \times (V_{nom} - V_0)}{V_{nom}} = \frac{100 \times (3.63 - 3.3)}{3.3} = 10$$

$$R_{adj-up} = \frac{5.1 \times 3.3 \times (100+10)}{1.225 \times 10} - \frac{510}{10} - 10.2 = 89.9(K\Omega)$$

The output voltage can also be trimmed by potential applied at the Trim pin.

$$V_O = (V_{trim} + 1.225) \times 1.347$$

Where V_{trim} is the potential that applied at the Trim pin, and V_o is the desired output voltage.

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

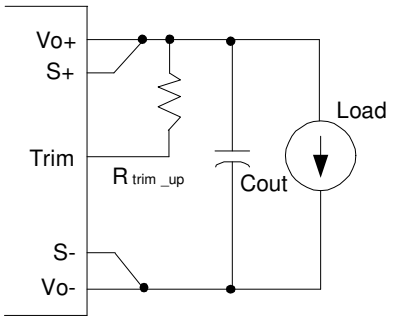

Figure 23 Trim up

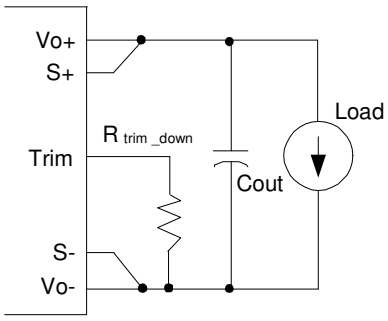

Figure 24 Trim down

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

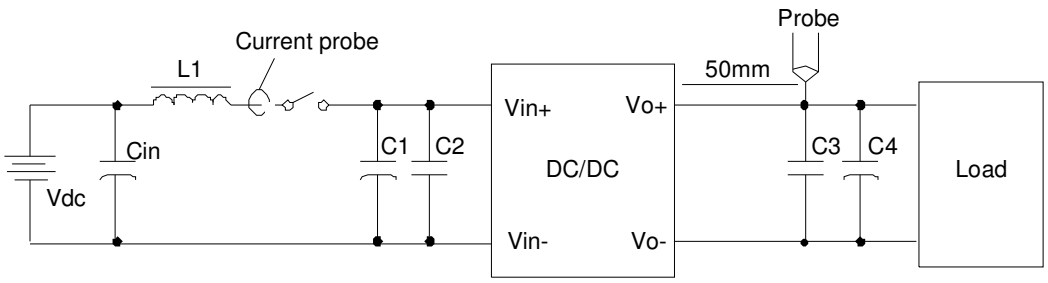

Figure 25 Input ripple & inrush current output ripple & noise test configuration

Vdc: DC power supply

L1: 12uH

Cin: 220uF/100V typical

C1 ~ C4: See Figure 20

Note - Using a coaxial cable with series 50ohm resistor and 0.68uF 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. See Figure 20.

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

Soldering

The product is intended for standard manual or wave soldering.

When wave soldering is used, the temperature on pins is specified to maximum 255 ^{O}C for maximum 10s.

When soldering by hand, the iron temperature should be maintained at 300 ^{O}C ~ 380 ^{O}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 for baseplate

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

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Hazardous Substances Announcement (RoHS of China R6)

Parts	Hazardous Substances					
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
AVO100B-48S3V3	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

Record of Revision and Changes

Issue	Date	Description	Originators
1.0	08.11.2014	First Issue	A. Zhang
1.1	07.22.2016	1. Add the model AVO100B-48S3V3PB-6L 2. Update the trim calculation formula	A. Zhang
1.2	08.22.2016	Update picture	K. Wang
1.3	11.15.2016	1. Update overshoot spec from 0 to 5% 2. Add Weight spec 3. Add Isolation Resistance ≥10Mohm 4. Soldering change time from 7s to 10s 5. Mechanical Diagram Open frame and Baseplate 3.3 change to 3. Add open frame Module with SMT pin Mechanical Diagram.	K. Wang

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