AVO100-48S2V5

87.5 Watts

Eighth-brick Converter

Total Power: 87.5Watts
Input Voltage: 36 to 75 Vdc
# of Outputs: Single

Special Features

- Delivering up to 35A output
- Ultra-high efficiency 90.8% typ. at full load
- Wide input range: 36V ~ 75V
- Excellent thermal performance
- No minimum load requirement
- Intended for reflow or wave soldering
- RoHS 6 compliant
- Remote control function
- Remote output sense
- Trim function: 80% ~ 110%
- Input under voltage lockout
- Output over current protection
- Output over voltage protection
- Over temperature protection
- Industry standard eighth-brick pin-out outline
- Pin length option:3.8mm

Safety

IEC/EN/UL/ 60950-1
CE Mark
UL/TUV
GB4943

Product Descriptions

The AVO100-48S2V5 is a single output DC/DC converter with standard eighth-brick form factor and pin configuration. It delivers up to 35A output current with 2.5V output. Ultra-high 90.8% 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 Status
AVO100-48S2V5-6L	2.5Vdc	Open-frame	Negative	R6
AVO100-48S2V5P-6L	2.5Vdc	Open-frame	Positive	R6
AVO100-48S2V5B-6L	2.5Vdc	Baseplate	Negative	R6
AVO100-48S2V5PB-6L	2.5Vdc	Baseplate	Positive	R6

Ordering information

AVO100	-	48	S	2V5	P	B	-	6	L
①		②	③	④	⑤	⑥		⑦	⑧

①	Model series	AVO: Standard eighth-brick series
②	Input voltage	48: 36V ~ 75V input range, rated input voltage 48V
③	Output number	S: single output
④	Rated output voltage	2V5: 2.5V output
⑤	Remote ON/OFF logic	Default: negative logic; P: positive logic
⑥	Baseplate	B: with baseplate; default: open-frame
⑦	Pin length	6: 3.8mm pin length
⑧	RoHS status	Y: Rohs, R5; 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	$V_{IN,DC}$	-	-	80	Vdc
Non-operating -100mS	All		-	-	100	Vdc
Maximum Output Power	All	$P_{O,max}$	-	-	87.5	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
Storage Temperature	All	T_{STG}	-55	-	+125	^{O}C
Voltage at remote ON/OFF pin	All		-0.7	-	12	Vdc
Humidity (non-condensing)						
Operating	All		-	-	95	%
Non-operating	All		-	-	95	%

Note 1 - 1mA for 60s, slew rate of 2000V/10s

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions[1]	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	$I_O = I_{O,max}$		1	-	3	V
Maximum Input Current ($I_O = I_{O,max}$)	$V_{IN,DC} = 36V_{DC}$	$I_{IN,max}$	-	-	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}	-	0.05	-	A
Standby Input Current	$V_{IN,DC} = 36V_{DC}$	$I_{IN,standby}$	-	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	Through 12uH inductor		-	-	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	- - -	90.8 91.7 87.5	- - -	% % %

Note 1 - Ta = 25 °C, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise noted.

Output Specifications

Table 3. Output Specifications:

Parameter		Conditions[1]	Symbol	Min	Typ	Max	Unit
Factory Set Voltage		$V_{IN,DC}$ = 48V_{DC} I_O=$I_{O,max}$	V_O	2.46	2.50	2.54	Vdc
Total Regulation		Inclusive of line, load temperature change, warm-up drift	V_O	2.41	2.50	2.59	Vdc
Output Voltage Line Regulation		All	±%V_O	-	0.1	0.2	%
Output Voltage Load Regulation		All	±%V_O	-	0.2	0.5	%
Output Voltage Temperature Regulation		All	±%V_O	-	-	0.02	%/^{O}C
Output Voltage Trim Range		All	V_O	2.0	-	2.75	V
Output Ripple, pk-pk		Measure with a 1uF ceramic capacitor in parallel with a 10uF tantalum capacitor, 0 to 20MHz bandwidth	V_O	-	70	-	mV_{PK-PK}
Output Current		All	I_O	0	-	35	A
Output DC current-limit inception[2]		All	I_O	37	-	50	A
V_O Load Capacitance[3]		All	C_O	330	-	10000	uF
V_O Dynamic Response	Peak Deviation	25%~50%~25% 25% load change slew rate = 0.1A/us	±V_O	-	30	-	mV
	Settling Time		T_s	-	60	-	uSec
	Peak Deviation	25%~50%~25% 25% load change slew rate = 1A/us	±V_O	-	160	-	mV
	Settling Time		T_s	-	50	-	uSec
Turn-on transient	Rise time	I_O = I_{max}	T_{rise}	-	5	50	mS
	Turn-on delay time	I_O = I_{max}	$T_{turn-on}$	-	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

Note 1 - Ta = 25 ^{O}C, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise noted.
Note 2 - Hiccup: auto-restart when over-current condition is removed.
Note 3 - High frequency and low ESR is recommended.

Output Specifications

Table 3. Output Specifications, con't:

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output voltage remote sense range	All	V_O	-	-	0.12	V
Output over-voltage protection[4]	All	V_O	2.95	-	4.0	V
Output over-temperature protection[5] With baseplate Without baseplate	 All All	 T T	 - -	 114 118	 - -	 ^{O}C ^{O}C
Over-temperature hysteresis	All	T	-	5	-	^{O}C
MTBF	Telcordia SR-332-2006; 80% load, 300LFM, 40 ^{O}C T_A		-	1.5	-	10^6 h

Note 4 - Hiccup: auto-restart when over-voltage condition is removed.
Note 5 - Auto recovery. See Figure 10,11 test point.

AVO100-48S2V5 Performance Curves

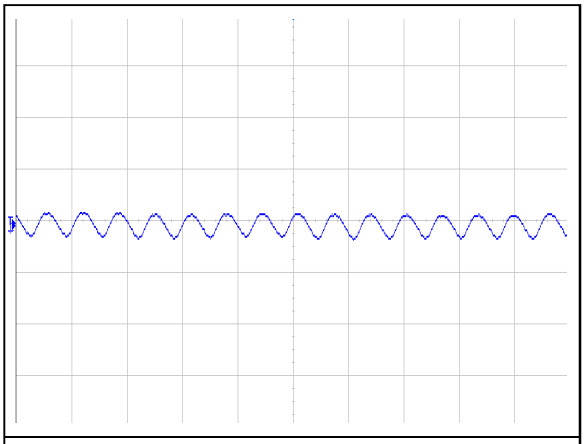


Figure 1: AVO100-48S2V5 Input Reflected Ripple Current Waveform

Ch 1: Iin (5uS/div, 10mA/div)

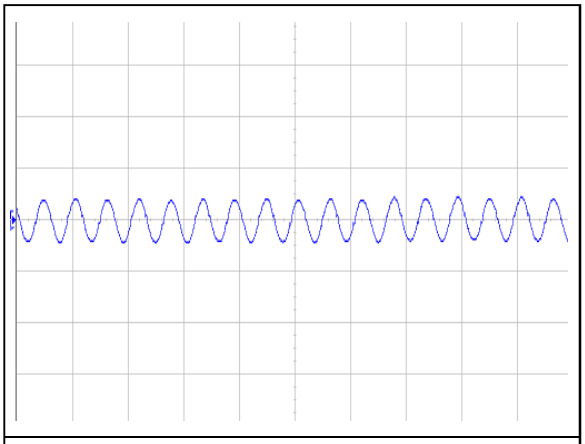


Figure 2: AVO100-48S2V5 Ripple and Noise Measurement

Ch 1: Vo (5uS/div, 50mV/div)

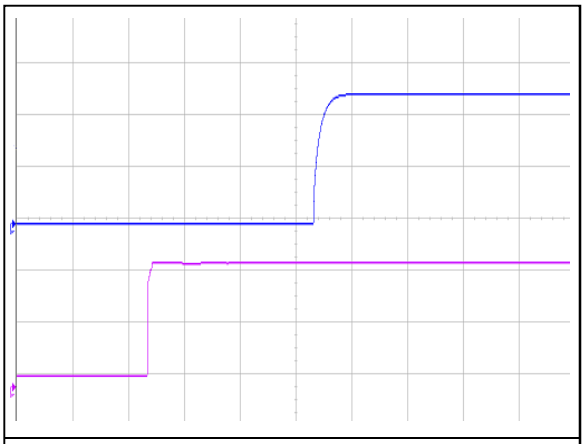


Figure 3: AVO100-48S2V5 Output Voltage Startup Characteristic (50mS/div)

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

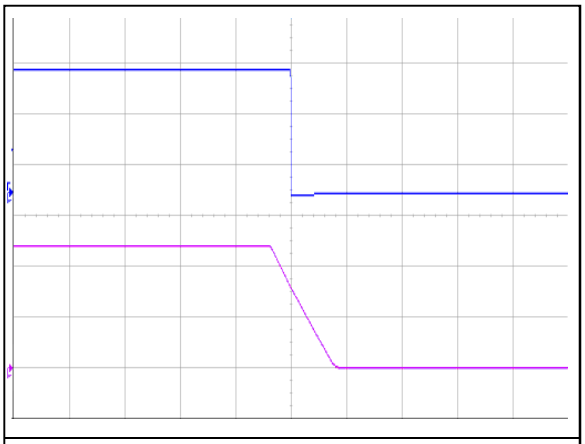


Figure 4: AVO100-48S2V5 Turn Off Characteristic (100mS/div)

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

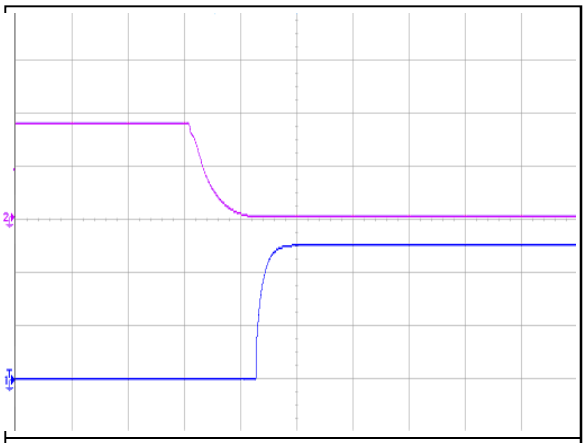


Figure 5: AVO100-48S2V5 Remote ON Waveform (20mS/div) Negative

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

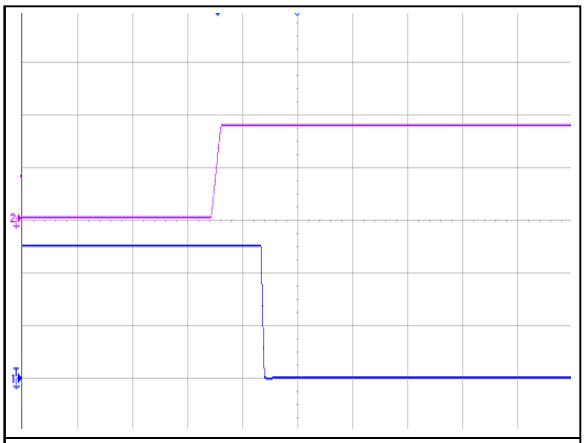


Figure 6: AVO100-48S2V5 Remote OFF Waveform (20mS/div) Negative

Ch 1: Vo (1V/div) CH3: Remote OFF (2V/div)

AVO100-48S2V5 Performance Curves

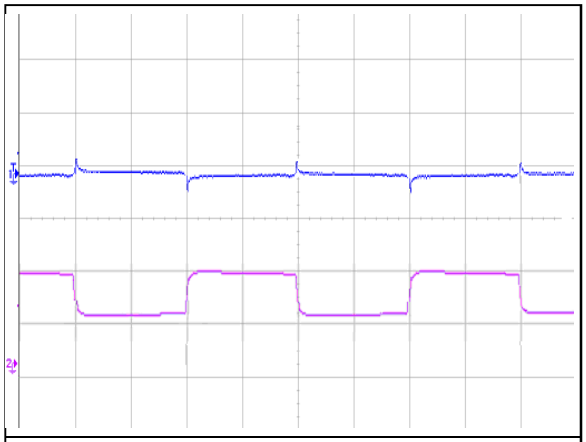


Figure 7: AVO100-48S2V5 Transient Response (2mS/div)
25%~50%~25% load change, 0.1A/uS slew rate
Ch 1: Vo (50mV/div) Ch 3: Io (10A/div)

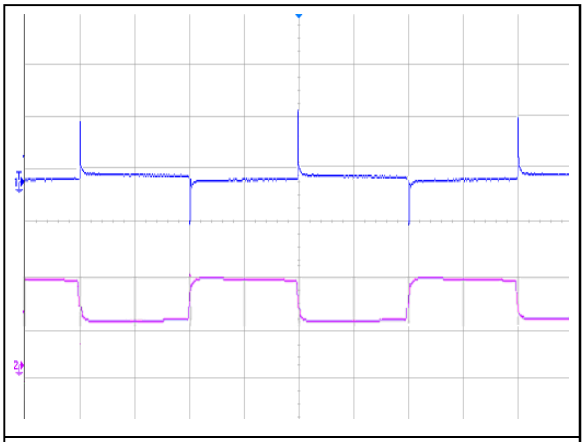


Figure 8: AVO100-48S2V5 Transient Response (2mS/div)
25%~50%~25% load change, 1A/uS slew rate
Ch 1: Vo (50mV/div) Ch 3: Io (10A/div)

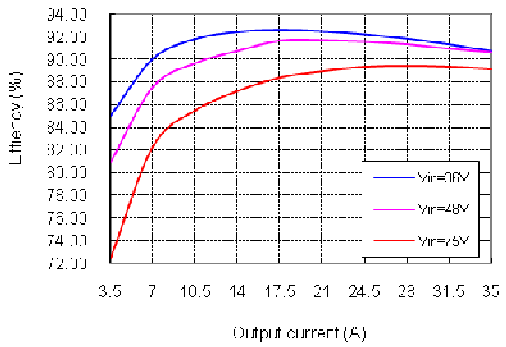


Figure 9: AVO100-48S2V5 Efficiency Curves @ 25 °C
Loading: Io = 10% increment to 35A

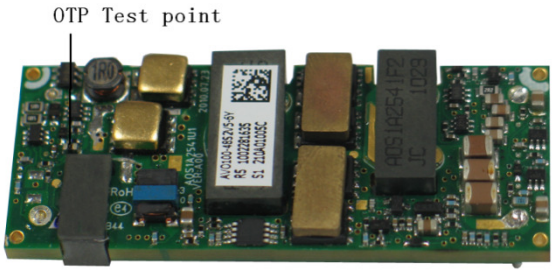


Figure 10: AVO100-48S2V5 OTP Test Point

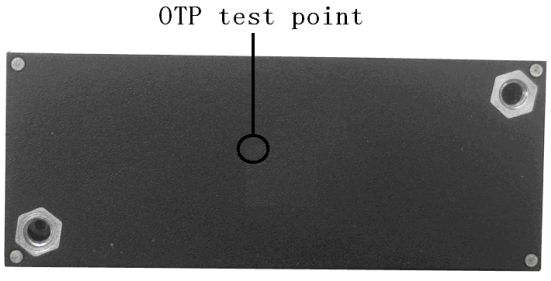
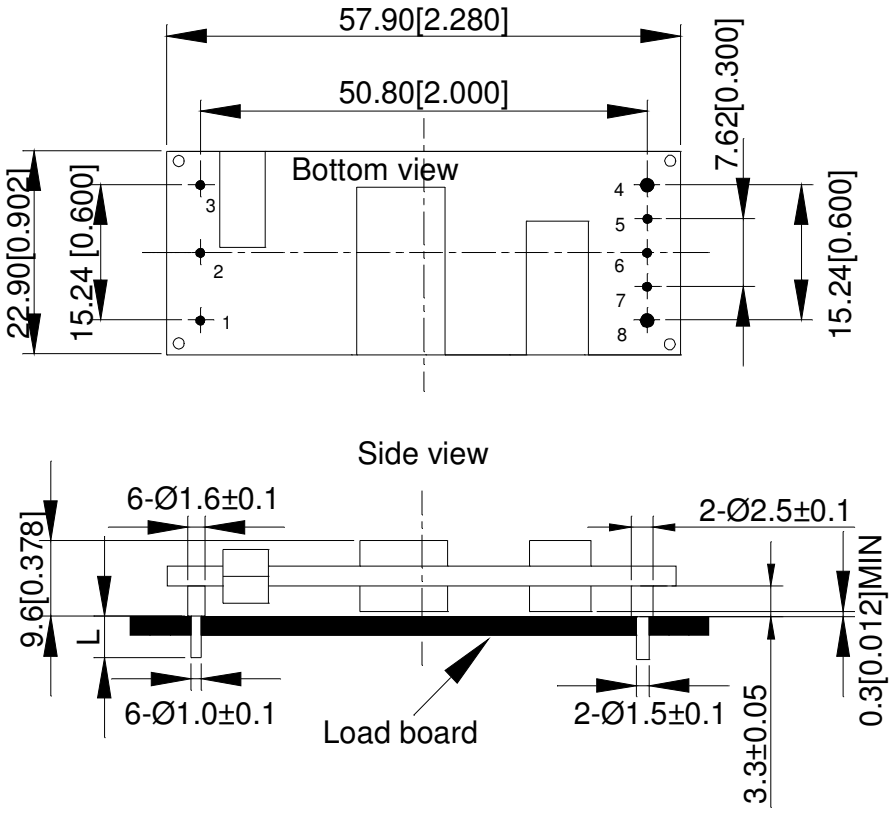


Figure 11: AVO100-48S2V5B OTP Test Point

Mechanical Specifications

Mechanical Outlines – Open-Frame Module

AVO100-48S2V5



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.]

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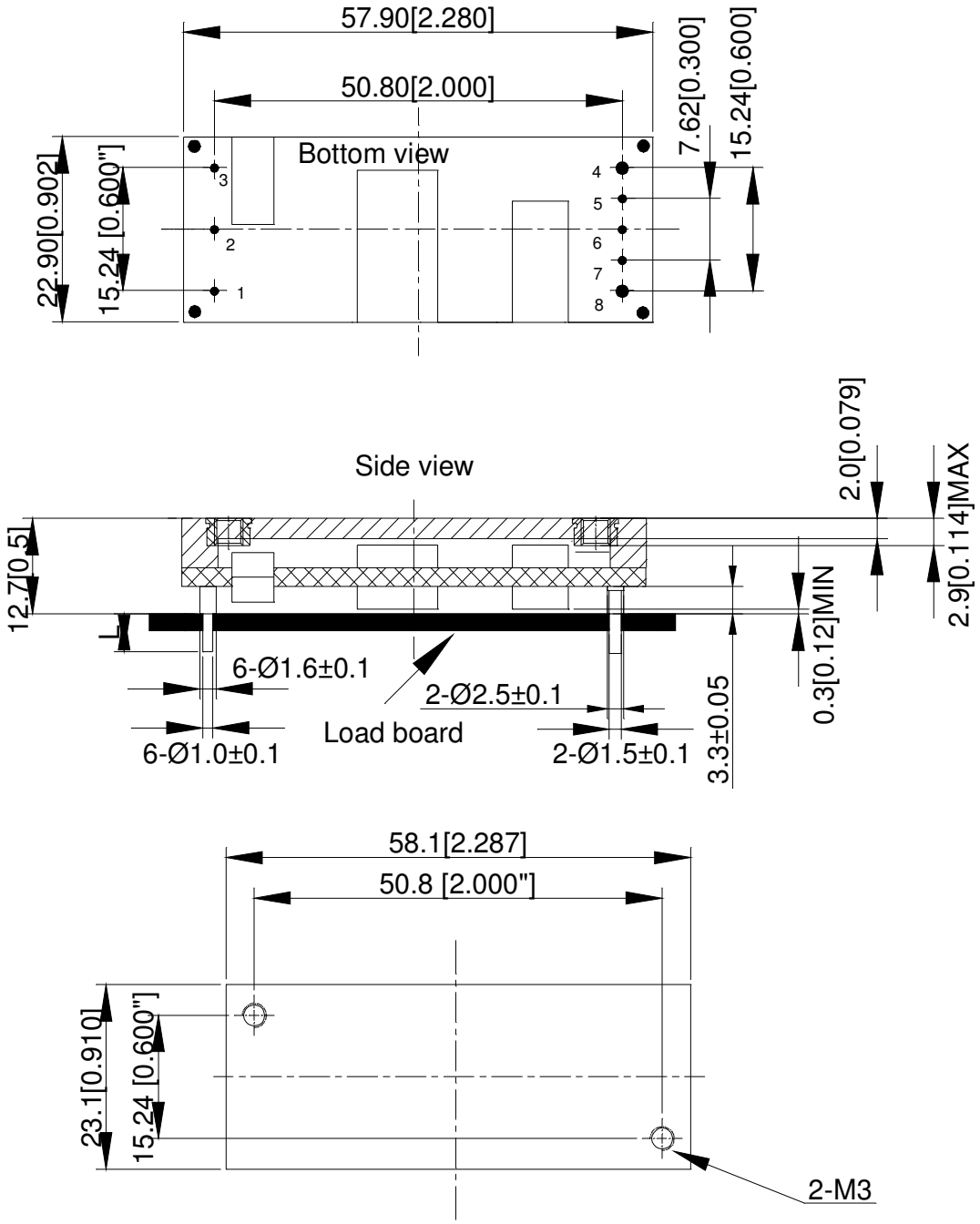
Mechanical Outlines – Baseplate Module

AVO100-48S2V5B



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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.]

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

AVO100-48S2V5 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.

Recommend EMC Filter Configuration

See Figure 17

Safety Certifications

The AVO100-48S2V5 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 AVO100-48S2V5 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

Operating Temperature

The AVO100 series 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 module

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 as shown in the Figure 12. The temperature at these test points should not exceed the maximum values in Table 6.

For a typical application, forced airflow direction is from Vin- to Vin+, Figure 13 shows the derating of output current vs. ambient air temperature at different air velocity.

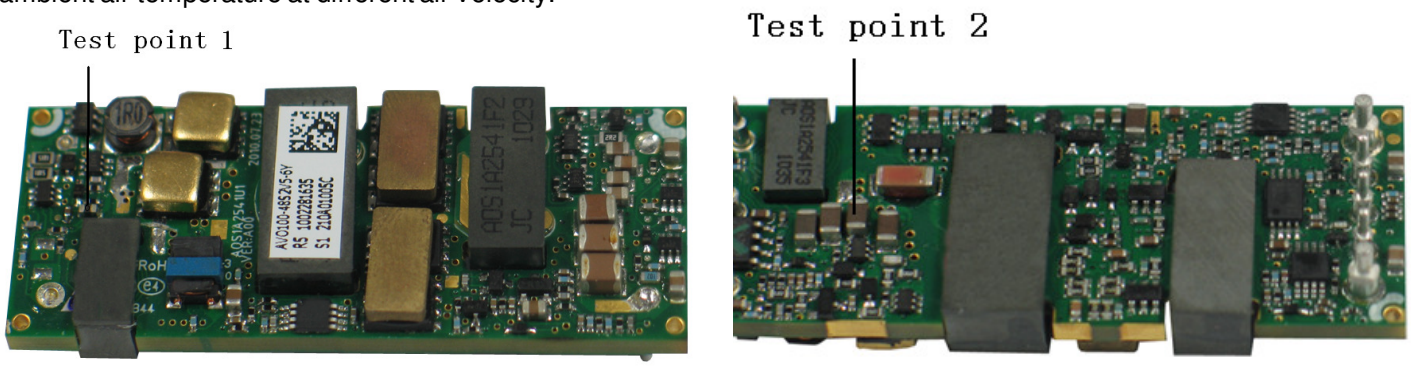

Figure 12 Temperature test point

Table 6. Temperature limit of the test point

Test Point	Temperature Limit
Test point 1	113 ^{O}C
Test point 2	118 ^{O}C

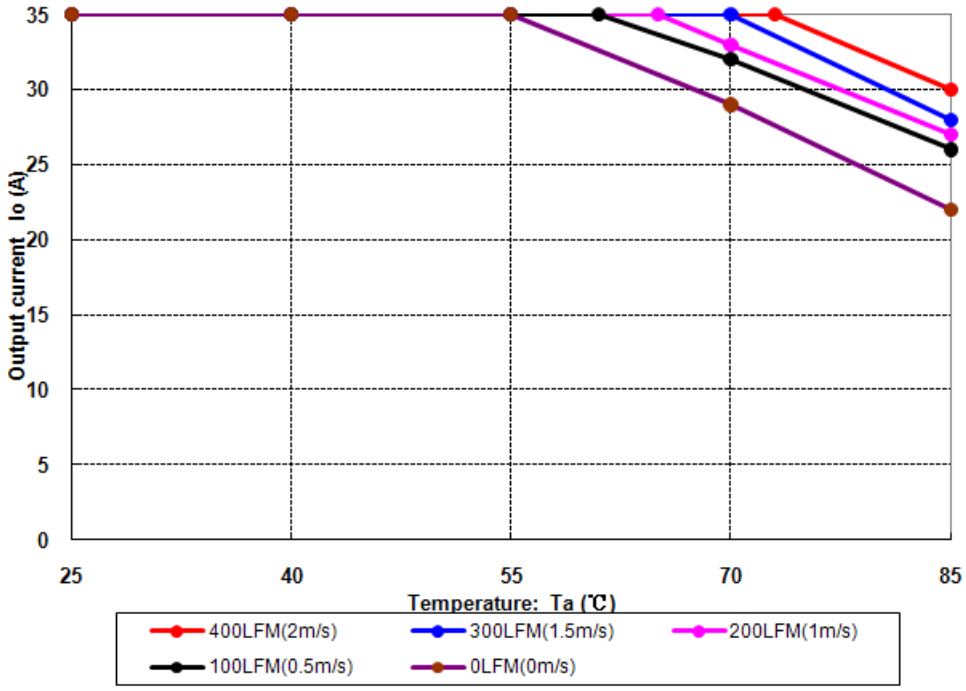

Figure 13 Output power derating, 48Vin, air flowing across the converter from Vin- and Vin+

Thermal Considerations –Baseplate module

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 points should not exceed the maximum values in Table 7.

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.

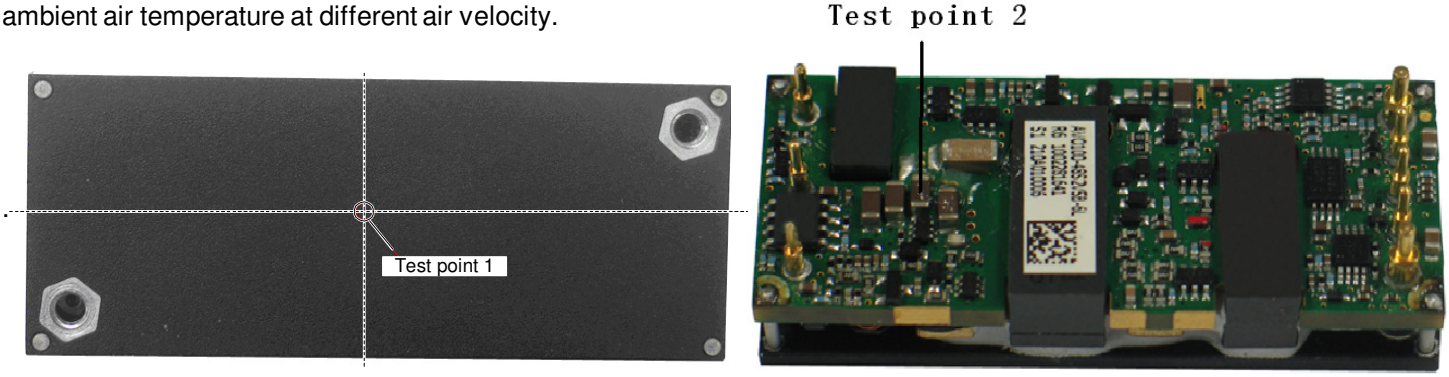

Figure 14 Temperature test point

Table 7. Temperature limit of the test point

Test Point	Temperature Limit
Test point 1	112 ^{O}C
Test point 2	118 ^{O}C

The converter can also operate with a smaller heatsink and sufficient airflow. The heatsink is shown in Figure 15.

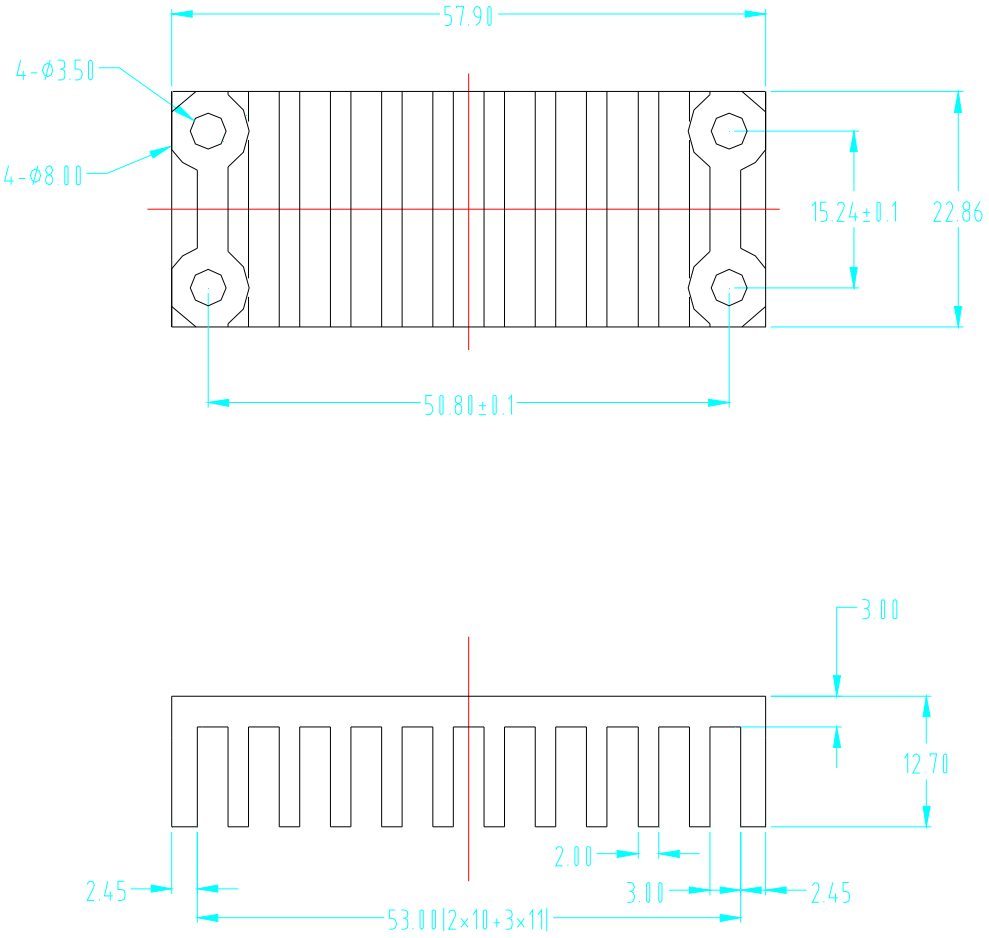

Figure 15 Heatsink (Unit:mm)

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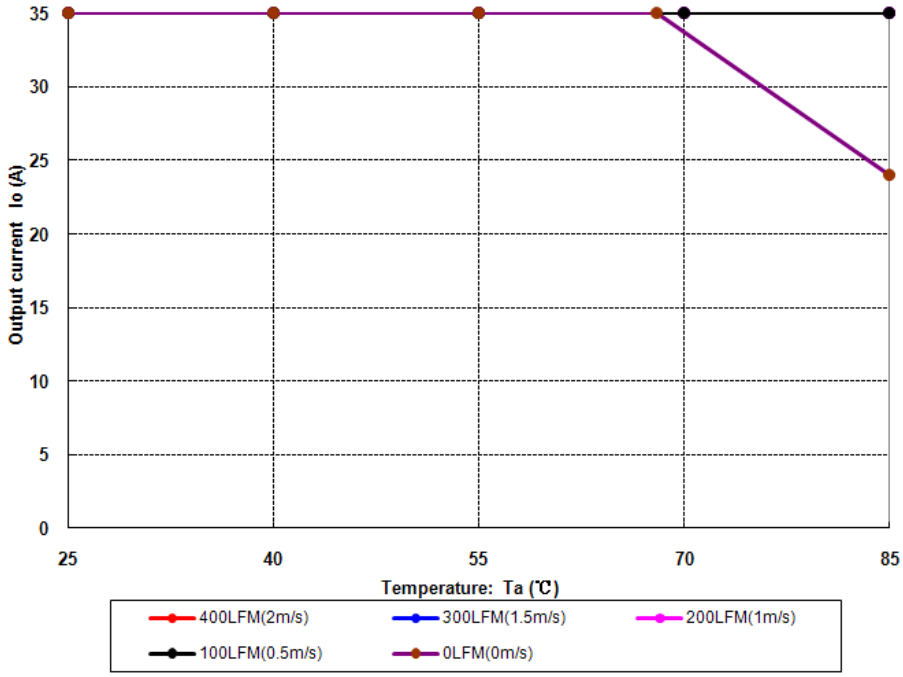

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Figure 16 Output power derating, 48Vin, air flowing across the converter from Vin- and Vin+

Assembly

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

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 AVO100-48S2V5 series power supply.

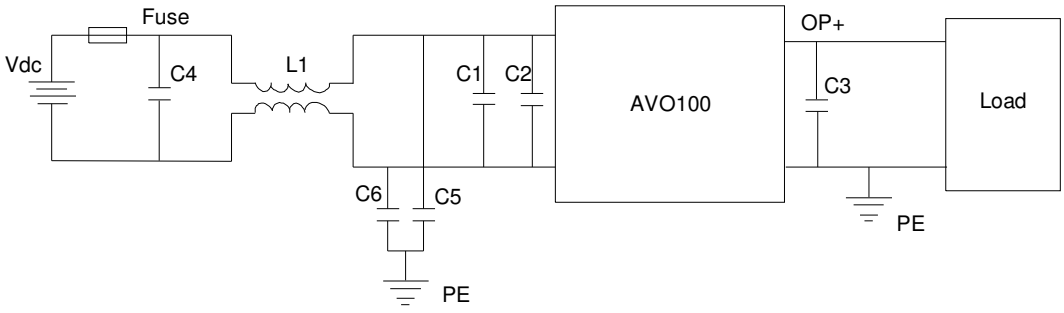

Figure 17 Typical application

Recommended input fuse: LITTLEFUSE 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

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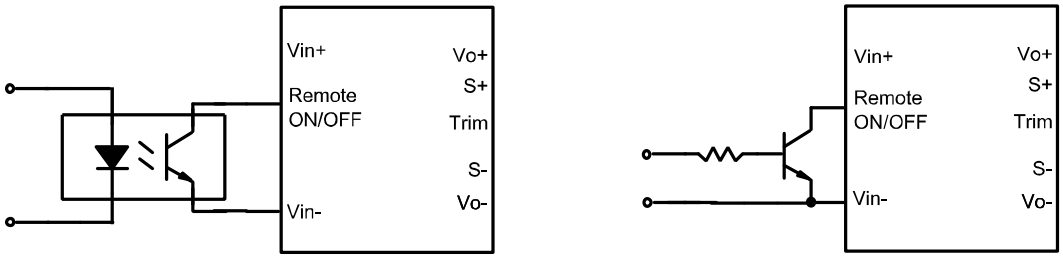
Remote ON/OFF

Either positive or negative remote ON/OFF logic is available in AVO100-48S2V5. 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 3 to ensure proper operation. The external Remote ON/OFF circuit in AVO100-48S2V5 is highly recommended as shown in Figure 18.



Isolated remote ON/OFF circuit

Non-isolated remote ON/OFF circuit

Figure 18 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 S+ for trimming down

R_{adj_up}

Value of external adjustment resistor which shall be connected between Trim and S- for trimming up.

$\Delta\%$

Output voltage change rate against nominal output voltage.

V_{out}: Nominal output voltage.

V_{ref} =1.225V

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

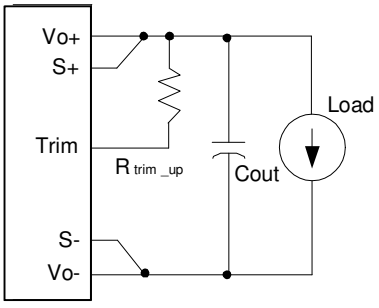


Figure 19 Trim up

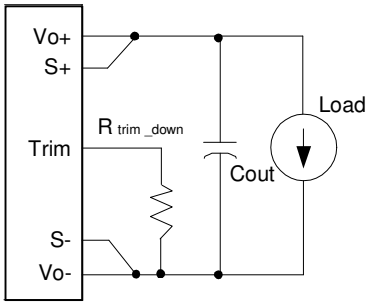


Figure 20 Trim down

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

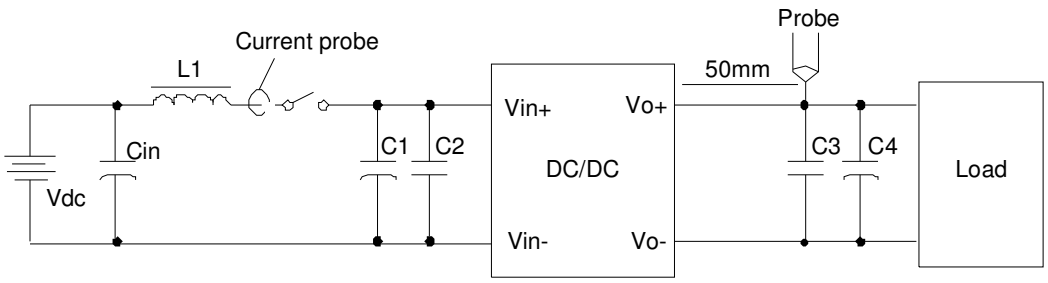


Figure 21 Input ripple & inrush current , output ripple & noise test configuration

Vdc: DC power supply

L1: 12uH

Cin: 220uF/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 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.

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

Soldering

√R6 Wave Soldering

The product is intended for standard manual, or wave soldering.

When wave soldering is used, the temperature on pins is specified to maximum 260 ^{O}C for maximum 7s.

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 simulative.

	Product requirement	Remark	Product Name
R6	Wave soldering	2.5V	AVO200-48S2V5B

√R6 Reflow/Wave Soldering

The product is intended for standard manual, reflow or wave soldering.

When reflow soldering is used, the temperature on pins is specified to maximum 260 ^{O}C for maximum 10s.

When wave soldering is used, the temperature on pins is specified to maximum 260 ^{O}C for maximum 7s.

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.

	Product requirement	Remark	Product Name
R6	Wave soldering	2.5V	AVO200-48S2V5

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Hazardous Substances Announcement (RoHS of China R6)

Parts	Hazardous Substances					
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
AVO100-48S2V5	x	x	x	x	x	x
AVO100-48S2V5B	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

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