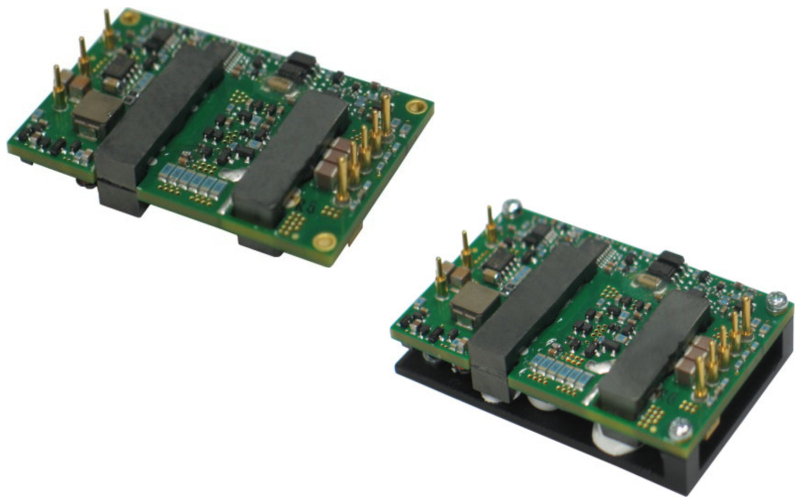
AVQ100-36S3V3

82.5 Watts

Quarter-brick Converter

Total Power: 82.5 Watts
Input Voltage: 18 to 60 Vdc
# of Outputs: Single



Special Features

- Delivering up to 25A output
- Ultra-high efficiency: 90% (typ., full load,48V).92% (typ.,hald load,24V)
- Wide input range: 18V ~ 60V
- Excellent thermal performance
- No minimum load requirement
- Start-up and shut-down monotonically into any normal and pre-biased loads, internal pre-bias function circuit prevents back negative current drawn from external load
- RoHS5/ 6,RoHS6/6compliant
- 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 quarter-brick pin-out outline
- Open frame or baseplate optional
- Pin length optional

Safety

IEC/EN/UL/ 60950-1
CSA-C22.2
CE Mark
UL/TUV
GB4943
EN55022 Class A

Product Descriptions

The AVQ100-36S3V3 is a single output DC/DC converter with standard quarter-brick outline and pin configuration. It delivers up to 25A output current with 3.3V output voltage. Above 90% ultra-high efficiency and excellent thermal performance makes it an ideal choice to used in telecom and datacom applications and can operate under 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
AVQ100-36S3V3-6L	3.3Vdc	Open frame	Negative	R6
AVQ100-36S3V3B-6L	3.3Vdc	Baseplated	Negative	R6

Ordering information

AVQ100	-	36	S	3V3	P	B	-	6	L
①		②	③	④	⑤	⑥		⑦	⑧

①	Model series	AVQ100: high efficiency quarter-brick series
②	Input voltage	36: 18V ~ 60V 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	Baseplated	B: baseplated; default:open frame
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 Non-operating -100mS	 All All	$V_{IN,DC}$	 - -	 - -	 60 80	 Vdc Vdc
Maximum Output Power	All	$P_{O,max}$	-	-	82.5	W
Isolation Voltage[1] Input to output Input to baseplate Output to baseplate	 Open frame module Baseplate module Baseplate module		 1500 1500 1500	 - - -	 - - -	 Vdc Vdc 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 Non-operating	 All		 - -	 - -	 95 95	%

Note 1 - 1mA for 60s, slew rate of 1500V/10s

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions[1]	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, DC	All	$V_{IN,DC}$	18	48	60	Vdc
Turn-on Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,ON}$	16.2	16.7	17.2	Vdc
Turn-off Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,OFF}$	14.6	15.1	15.6	Vdc
Lockout Voltage Hysteresis	$I_O = I_{O,max}$		1.1	1.6	2.1	V
Maximum Input Current ($I_O = I_{O,max}$)	$V_{IN,DC}$ =18V $I_O = I_{O,max}$	$I_{IN,max}$	-	-	6	A
No-load input current	I_O = 0A	I_{IN}	-	-	0.1	A
Standby Input current	Remote OFF	I_{IN}	-	0.005	0.01	A
Inrush current transient rating	Power ON		-	-	0.5	A^2s
Recommended Input Fuse	Fast blow external fuse recommended		-	-	15	A
Input filter component values (C\L)	Internal values		-	7.6\2.2	-	μF\μH
Recommended External Input Capacitance	Low ESR capacitor recommended	C_{IN}	-	100	-	uF
Input Reflected Ripple Current	Through 12uH inductor		-	10	20	mA
Operating Efficiency	T_A=25 °C Vin=24V_{DC} $I_O = I_{O,max}$ $I_O = 50\% I_{O,max}$	η	- -	90 92	- -	% %
	T_A=25 °C Vin=48V_{DC} $I_O = I_{O,max}$ $I_O = 50\% I_{O,max}$	η	- -	90.5 90	- -	% %

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

Output Specifications

Table 3. Output Specifications:

Parameter	Condition[1]	Symbol	Min	Typ	Max	Unit
Factory Set Voltage	$V_{IN,DC} = 48V_{DC}$ $I_O = I_{O,max}$	V_O	3.267	3.300	3.333	Vdc
Output Voltage Line Regulation	All	$\%V_O$	-	0.05	-0.15	%
Output Voltage Load Regulation	All	$\%V_O$	-	0.05	0.15	%
Output Voltage Temperature Regulation	All	$\%V_O$	-	0.02	-	$\%/^OC$
Total output voltage range (Over sample, line, load, temperature & life)	All	V_O	3.25	3.30	3.35	V
Output Voltage Trim Range	All	V_O	2.64	-	3.63	V
Output Ripple, pk-pk	20MHz bandwidth	V_O	-	40	70	mV_{PK-PK}
Output Current	All	I_O	0	-	25	A
Output DC current-limit inception[2]	All	I_O	27.5	-	35	A
Reverse current-limit while enabled[3]	All		0.5	1.0	2.0	A
Reverse current-limit while disabled[4]	All		0	10	50	mA
Vout pre-bias level	All	$\%V_O$	-	-	90	%
V_O Load Capacitance[5]	All	C_O	470	470	10000	uF
V_O Dynamic Response Peak Deviation Settling Time	50% ~75%~50% slew rate = 0.1A/us	$\pm V_O$ T_s	- -	150 100	- -	mV uSec
	50% ~75%~50% slew rate = 1A/us	$\pm V_O$ T_s	- -	180 200	- -	mV uSec
Turn-on transient: Rise time	$I_O = I_{max}$	T_{rise}	-	10	30	mS
Turn-on transient: Turn-on delay time	$I_O = I_{max}$	$T_{turn-on}$	-	5	10	mS
Turn-on transient: Output voltage overshoot	$I_O = 0$	$\%V_O$	-	0	-	%
Switching frequency	All	f_{SW}	295	300	305	KHz

Note 1 - Ta = 25 ^OC, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise noted.
Note 2 - Hiccup: auto-restart when over-current condition is removed.
Note 3 - Negative current drawn from output
Note 4 - Negative current drawn from output
Note 5 - High frequency and low ESR is recommended.

Output Specifications

Table 3. Output Specifications, con't:

Parameter		Condition[1]	Symbol	Min	Typ	Max	Unit
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[6]		All	V_O	3.8	4.2	5.0	mV
Output over-temperature protection[7]		No baseplate	T	-	118	-	^OC
		Baseplate		-	100	-	^OC
Over-temperature hysteresis		All	T	-	5	-	^OC
Output voltage remote sense range		All	$\pm V_O$	-	-	0.5	V
MTBF		Telcordia SR-332-2006; 80% load, 300LFM, 40^{O}C Ta		-	2.5	-	10^6 h

Note 6 - Hiccup: auto-restart when over-voltage condition is removed.

Note 7 - Auto recovery.

AVQ100-36S3V3 Performance Curves

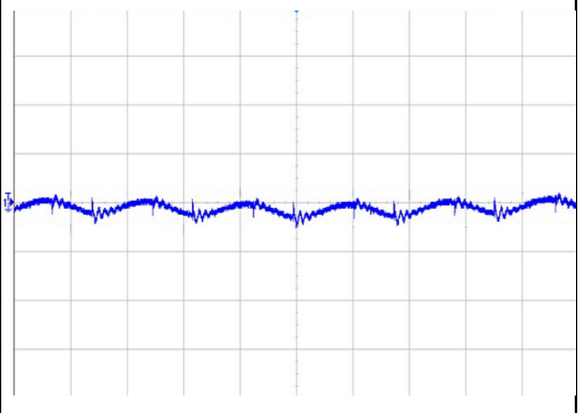


Figure 1: AVQ100-36S3V3 Input Reflected Ripple Current Waveform (2uS/div, 5mA/div)

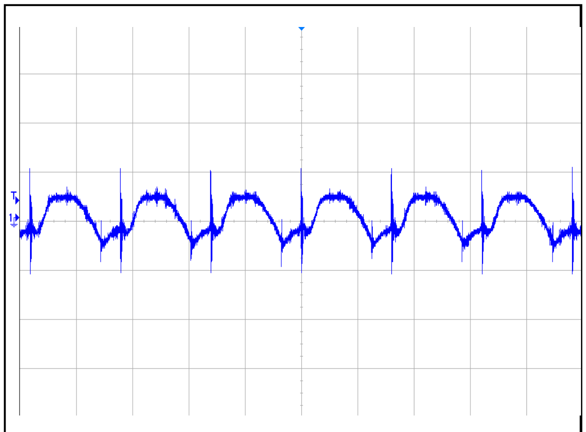


Figure2: AVQ100-36S3V3 Ripple and Noise Measurement (2uS/div, 20mV/div)

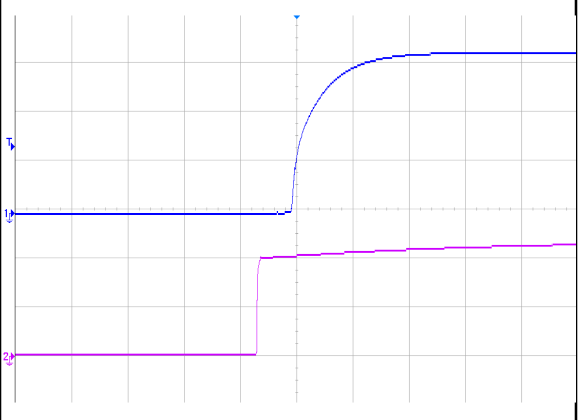


Figure 3: AVQ100-36S3V3 Output Voltage Startup Characteristic (5mS/div)

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

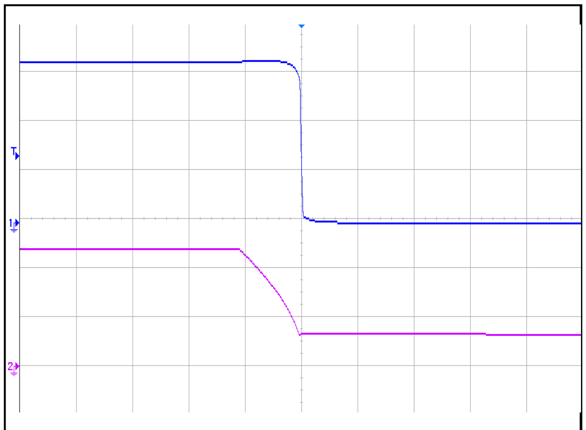


Figure 4: AVQ100-36S3V3 Turn Off Characteristic (2mS/div)

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

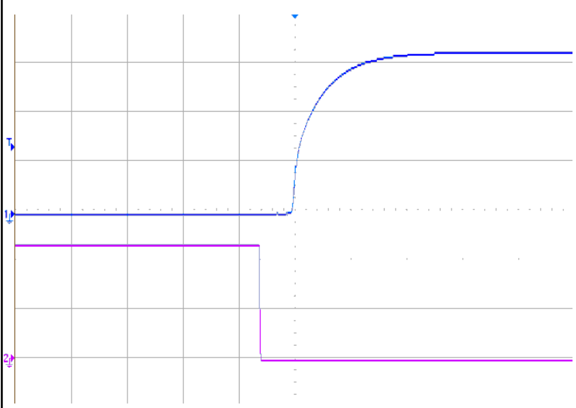


Figure 5: AVQ100-36S3V3 Remote ON Waveform (5mS/div)

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

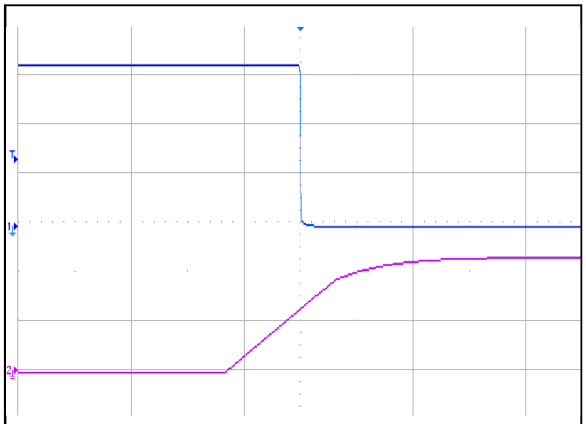


Figure 6: AVQ100-36S3V3 Remote OFF Waveform (5mS/div)

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

AVQ100-36S3V3 Performance Curves

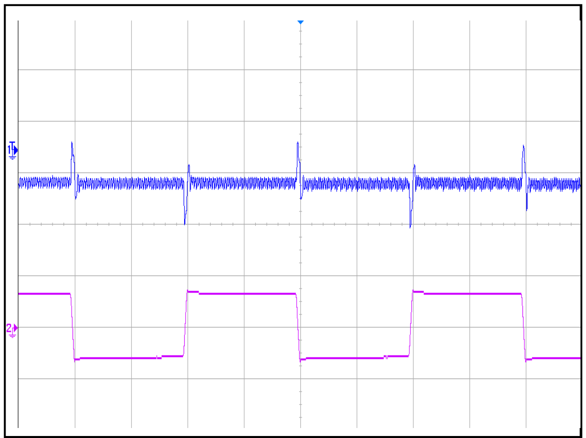


Figure 7: AVQ100-36S3V3 Transient Response (1mS/div)
50%~75%~50% load change, 0.1A/uS slew rate
Ch 1: Vo (50mV/div) Ch 2: Io (2A/div)

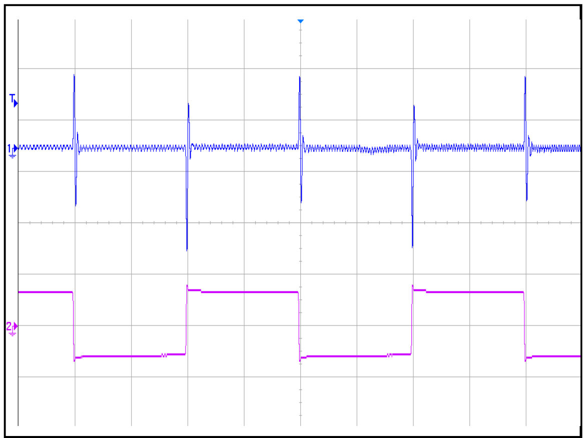


Figure 8: AVQ100-36S3V3 Transient Response (1mS/div)
50%~75%~50% load change, 1A/uS slew rate
Ch 1: Vo (100mV/div) Ch 2: Io (2A/div)

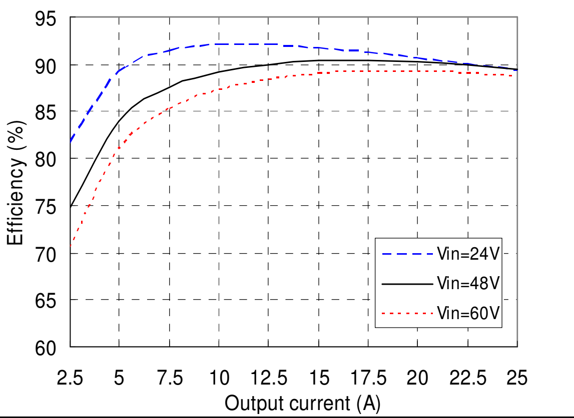
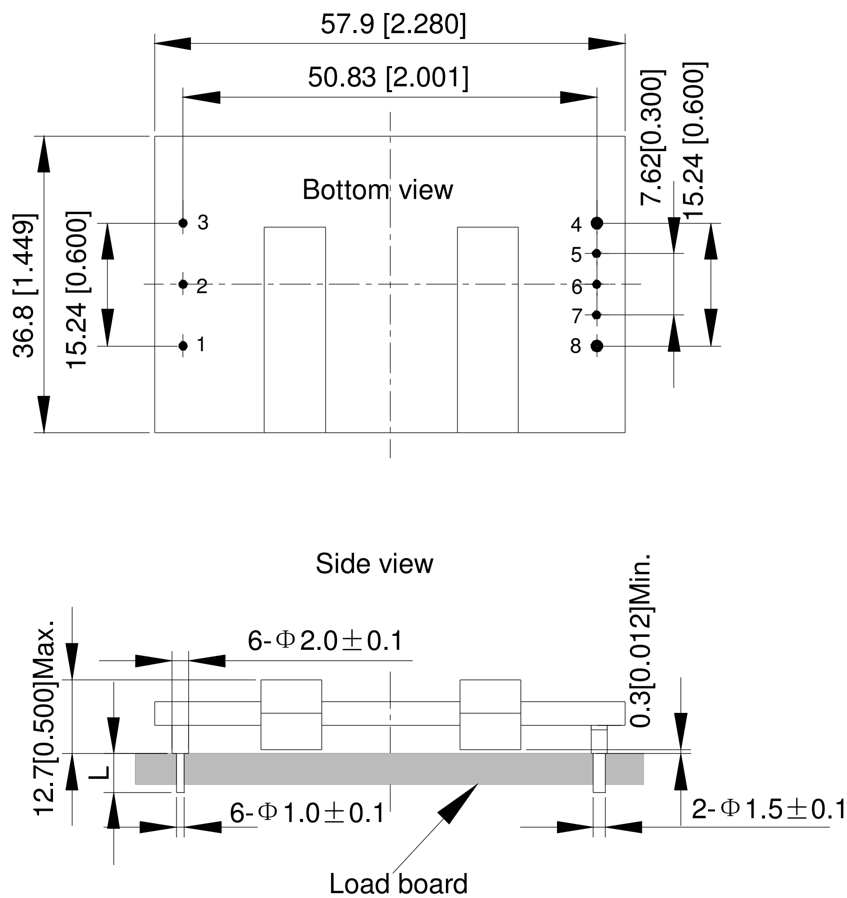


Figure 9: AVQ100-36S3V3 Efficiency Curves @ 25 °C, Vo=3.3V

Mechanical Specifications

Mechanical Outlines – No baseplate Module



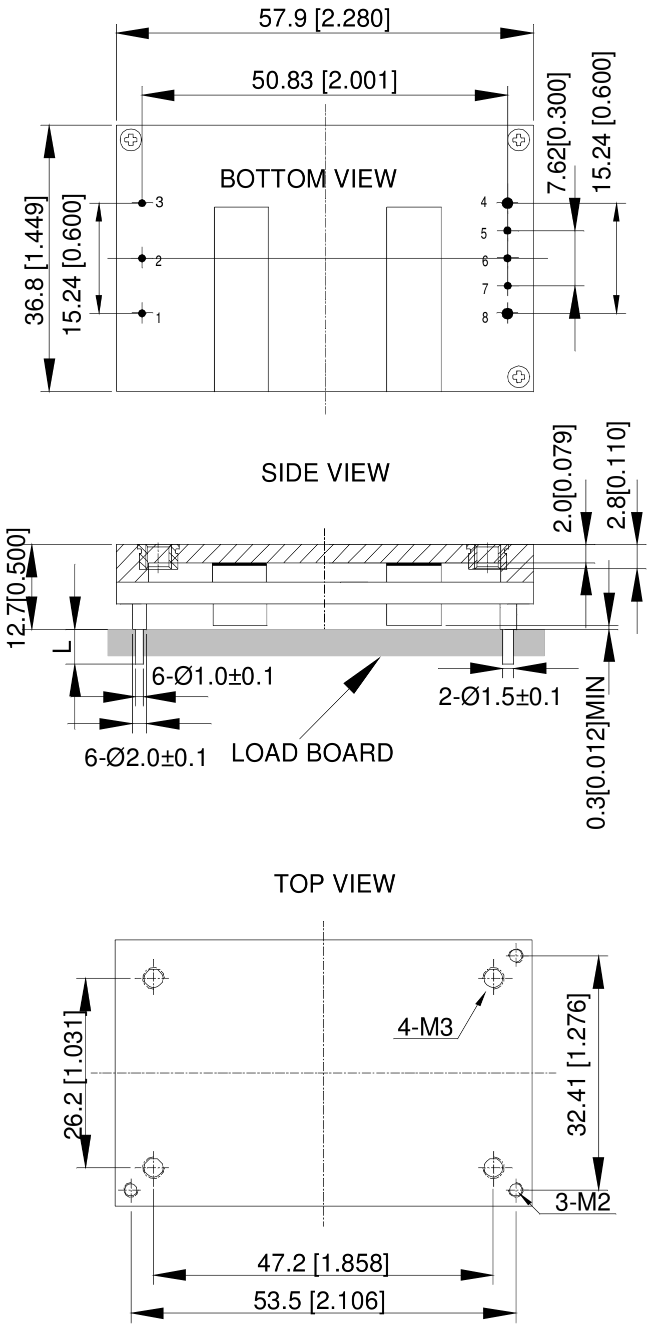
Unit: mm[inch]　　Bottom view: pin on upside

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

X.XXmm±0.25mm[X.XX in.±0.01in.]

Figure 10 Mechanical diagram

Mechanical Outlines – Baseplate Module



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 11 Mechanical diagram

Pin Length Option

Device code suffix	L
-4	4.8mm±0.2 mm
-6	3.8mm±0.2 mm
-8	2.8mm±0.2 mm
None	5.8mm±0.2 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

AVQ100-36S3V3 Series power supply is designed to meet the following EMC immunity 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 61000-4-4, Level 3	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
IEC/EN 61000-4-6, Level 2	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Continuous Conducted Interference. DC input port	A
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.

EMC Test Configuration

:

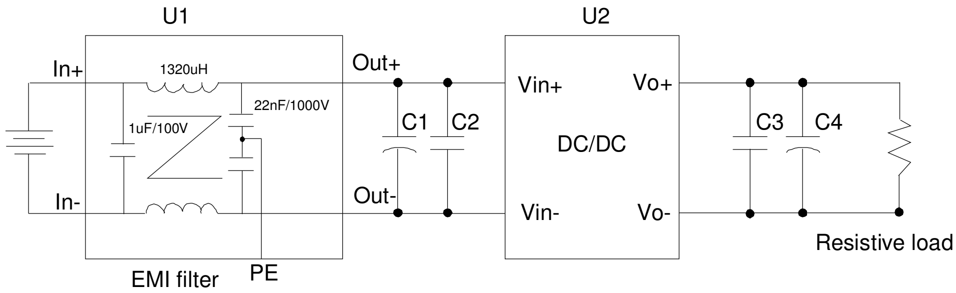


Figure 12 EMC test configuration

U1: 5A input EMC filter module

U2: Module to test, AVQ100-36S3V3

C1 ~ C4: See Figure 22

Baseplate: Be not connected

Safety Certifications

The AVQ100-36S3V3 Series 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 4. Safety Certifications for AVQ100-36S3V3 series power supply system

Document	File #	Description
UL60950-1,CSA-C22.2		US and Canada Requirements
EN60950-1, EN55022		European Requirements
IEC60950-1		International Requirements
GB4943		Chinese Requirements
CE		CE Marking
TVU		German Requirements

Operating Temperature

The AVQ100-36S3V3 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 －No baseplate Model

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 OTP Test Point. The temperature at this point should not exceed the max values in the table5.

For a typical application, Figure 15 and Figure 16 show the derating of output current vs. ambient air temperature at different air velocity.

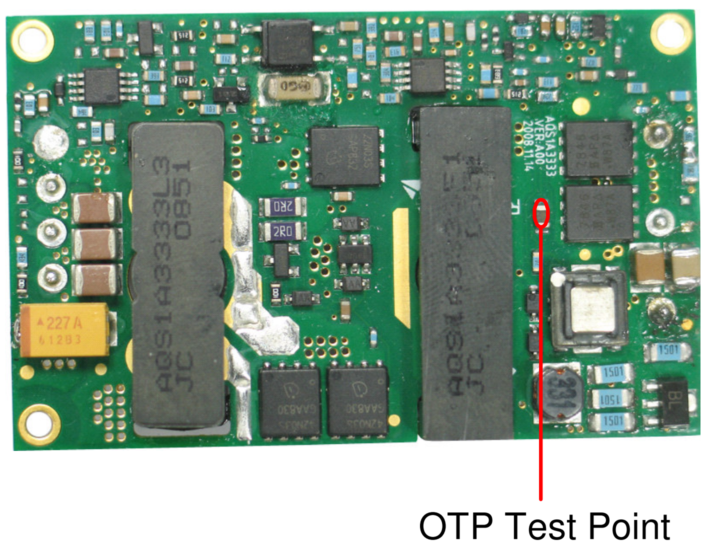


Figure 13 Thermal test points

Table 5 Temperature limit of the test points

Test point	Temperature limit
OTP Test Point	113^{O}C

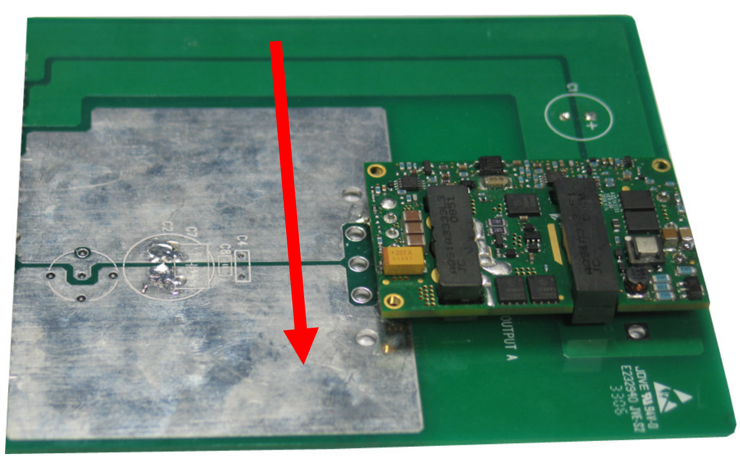


Figure 14 Typical test condition Forced airflow direction is from V_{in}- to V_{in}+

Thermal Considerations — No Baseplate Model Con't

The converter can operate with a smaller heatsink and sufficient airflow. Figure 15 & Figure 16 show the derating output current vs. ambient air temperature at different air velocities with a specified heatsink.

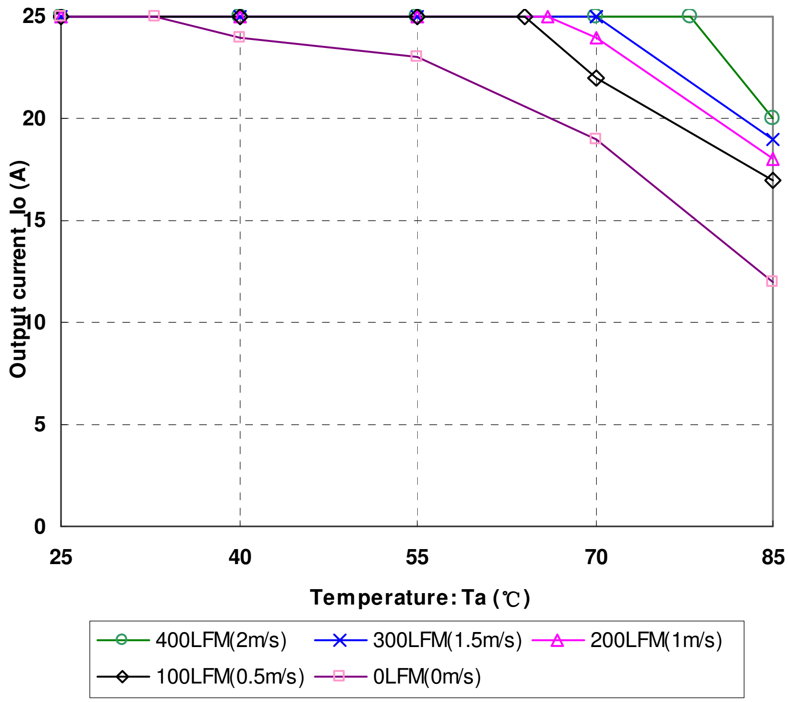


Figure 15 Output power derating, $48V_{in}$, air flowing across the converter from V_{in}- to V_{in}+

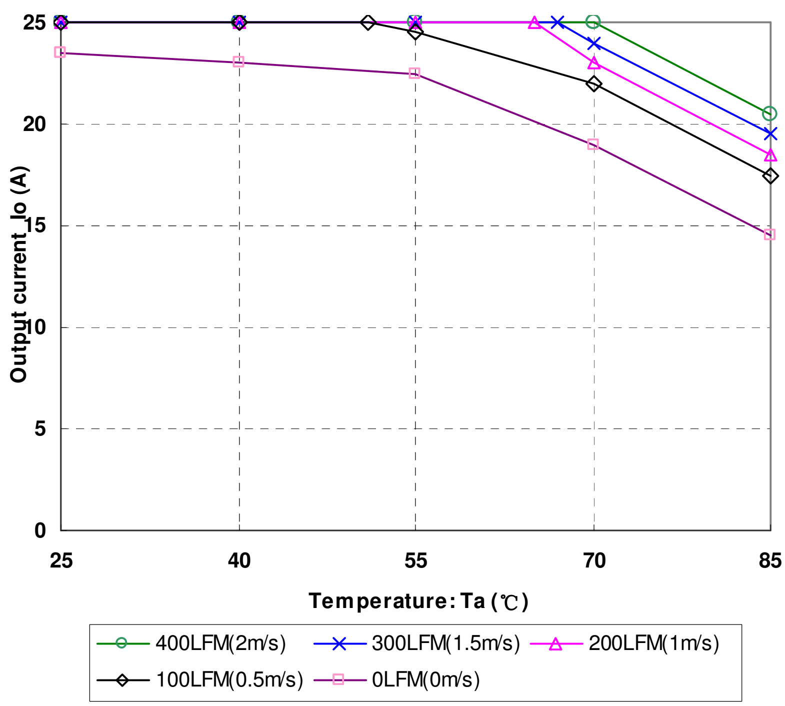


Figure 16 Output power derating, $24V_{in}$, air flowing across the converter from V_{in}- to V_{in}+

Thermal Considerations — Baseplate Model

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 point(s). The temperature at this/these point(s) should not exceed the max values in the table6.

The converter can operate in an enclosed environment without forced air convection. Cooling of the converter is achieved mainly by conduction from the baseplate to a heatsink. The converter can deliver full output power at 85 ^{O}C ambient temperature provided the baseplate temperature is kept below the max values in the table6.

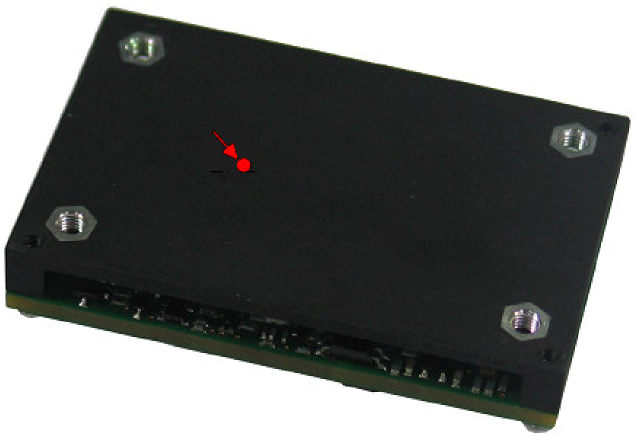


Figure 17 Test point on baseplate

Table 6 Temperature limit of the test points

Test point	Temperature limit
OTP Test Point	95 ^{O}C

The converter can also operate with a smaller heatsink and sufficient airflow. Figure20 & Figure21 shows the derating output current vs. ambient air temperature at different air velocity with a specified heatsink.

The typical test condition is shown in Figure 18

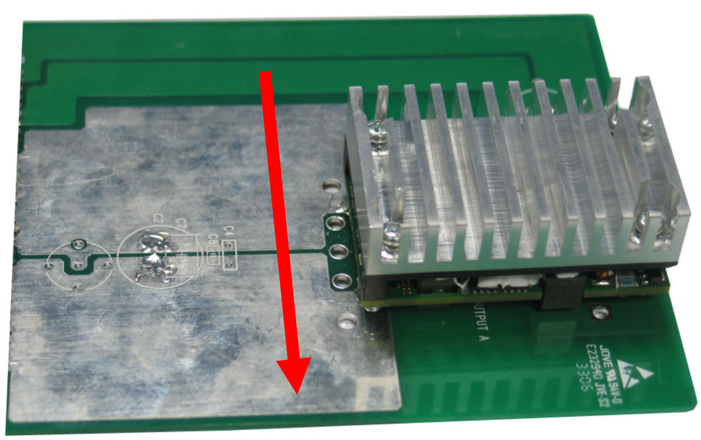


Figure 18 Typical test condition, Forced airflow direction is from Vin- to Vin+

Thermal Considerations — Baseplate Model Con't

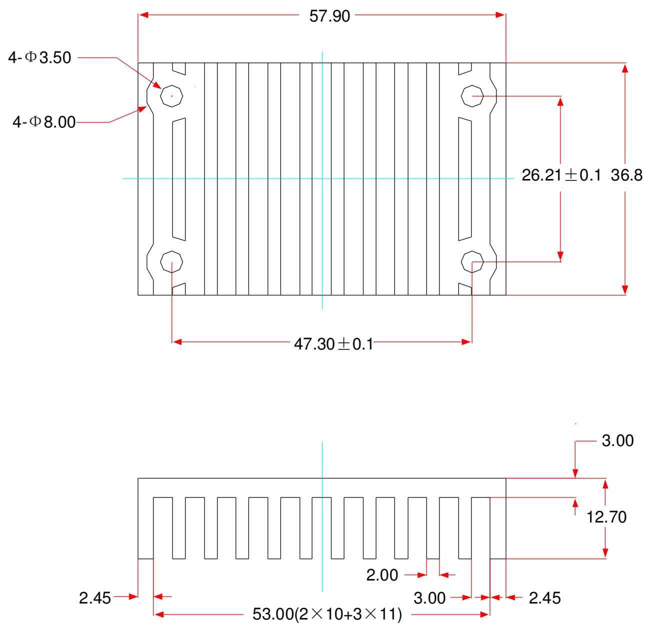


Figure 19 Outline drawing of the heatsink

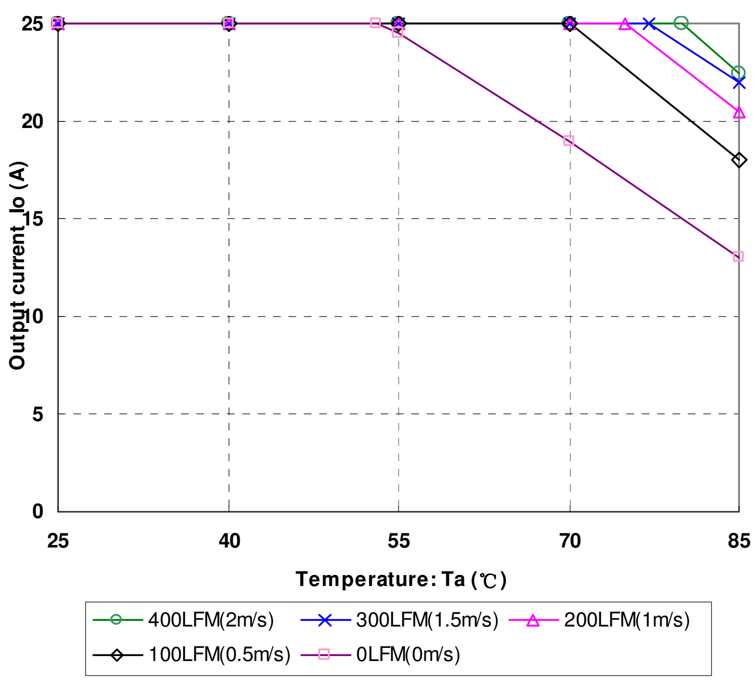


Figure 20 Output power derating, 48V_{in}, air flowing across the converter from V_{in}- to V_{in}+

Thermal Considerations — Baseplate Model Con't

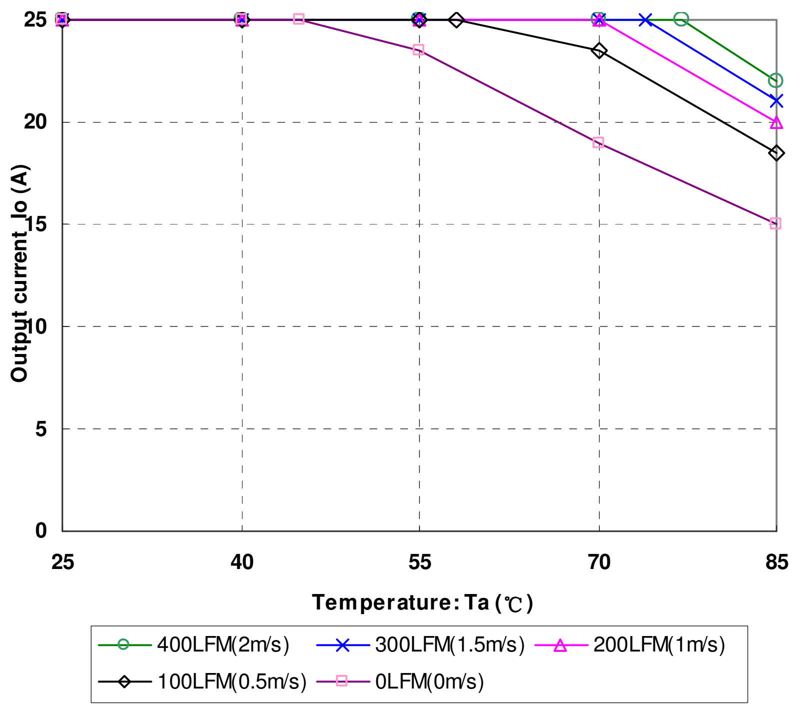


Figure 21 Output power derating,24V_{in}, air flowing across the converter from V_{in}- to V_{in}+

Assembly

The allowable maximum distance of the screw drove 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/axes
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

Typical Application

Below is the typical application of the AVQ100-36S3V3 series power supply.

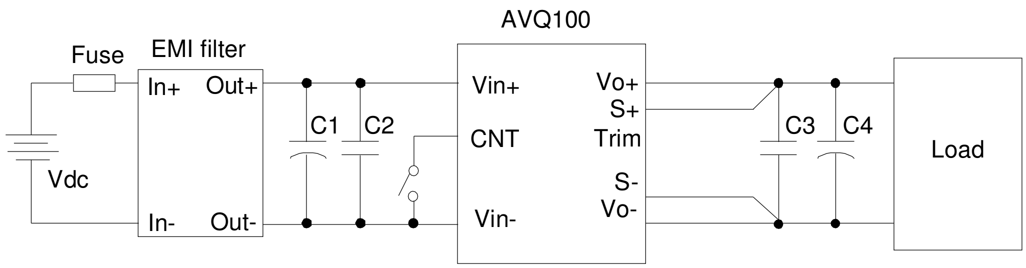


Figure 22 Typical application

C1: 100µF/100V electrolytic capacitor, P/N: UPW2A101MHD (Nichicon) or equivalent caps

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

C3: 1µF/25V X7R ceramic capacitor, P/N: C3225X7R1E105KT000N (TDK) or equivalent caps

C4: 470µF electrolytic capacitor, P/N: UUD1H471MNL1GS (Nichicon) or equivalent caps

Fuse: External fast blow fuse with a rating of 15A. The recommended fuse model is 0324020 MXP from LITTLEFUSE.

Remote ON/OFF

Either positive or negative remote ON/OFF logic is available in AVQ100-36S3V3. The logic is CMOS and TTL compatible. Below is the detailed internal circuit and reference in AVQ100-36S3V3.

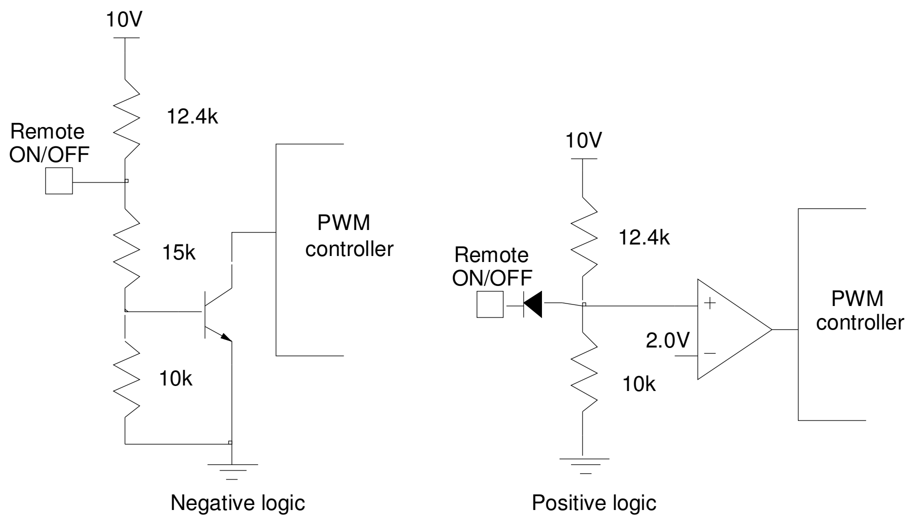


Figure 23 Remote ON/OFF internal diagram

Trim Characteristics

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

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

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

$$\Delta = \frac{|V_{nom} - V_{desired}|}{V_{nom}} \times 100$$

V_{norm}: Nominal output voltage.

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

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

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

$$V_O = (V_{trim} + 1.225) \times 2.69$$

Where V_{trim} is the potential 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 and the minimum input voltage should be increased as shown in the following figures.

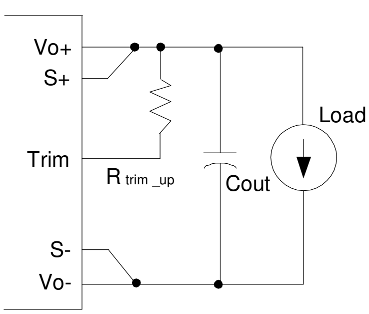


Figure 24 Trim up

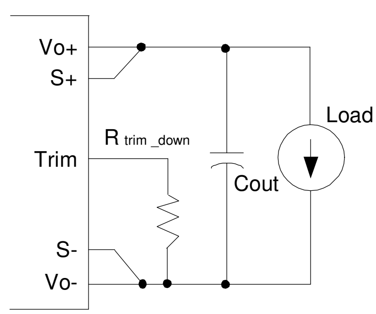


Figure 25 Trim down

Input Ripple & Output Ripple & Noise Test Configuration

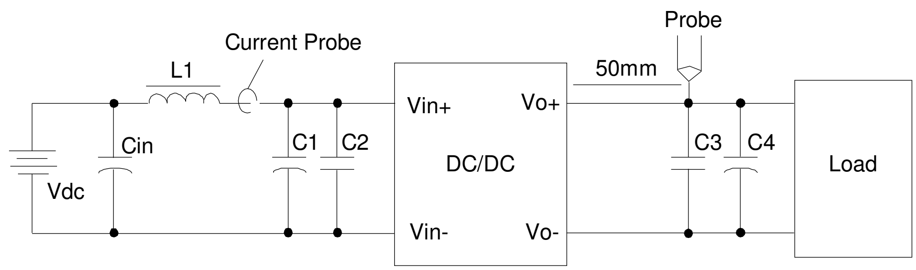


Figure 26 Input ripple & inrush current, ripple & noise test configuration

Vdc: DC power supply

L1: 12μH

Cin: 220μF/100V typical

C1 ~ C4: See Figure 22

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. See Figure 22.

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，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}Cfor maximum 7s.

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

Hazardous Substances Announcement (RoHS of China R6)

Parts	Hazardous Substances					
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
AVQ100-36S3V3	x	x	x	x	x	x
AVQ100-36S3V3B	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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