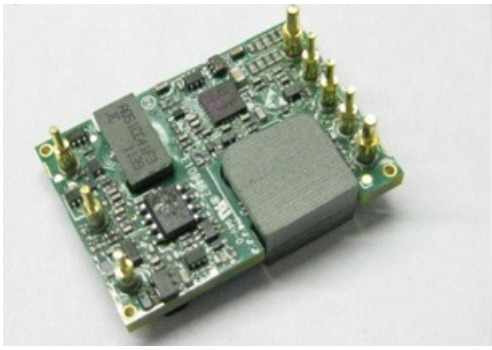
AVD85-48S3V3

82.5 Watts

Sixteenth-brick Converter



Total Power: 82.5 Watts
Input Voltage: 36 to 75 Vdc
# of Outputs: Single

Special Features

- Delivering up to 25A output current
- Ultra high efficiency 91.5% typ. at full load
- 2:1 wide input voltage: 36 ~ 75V
- Excellent thermal performance
- No minimum load requirement
- Basic isolation
- High power density
- Low output noise
- RoHS Directive(EU) 2015/863 (RoHS 3.0)
- Remote control function (negative logic)
- Remote output sense
- Trim function: 80% ~ 110%
- Input under voltage lockout
- Output over current protection
- Output short circuit protection
- Output over voltage protection
- Over-temperature protection
- Industry standard sixteenth-brick pin-out outline

Safety

IEC/EN/UL/CSA 62368-1
CE Mark
TUV 62368-1

Product Descriptions

The AVD85-48S3V3 is a single output DC/DC converter with standard sixteenth-brick form factor and pin configuration. It delivers up to 25A output current with 3.3V output. Ultra-high 91.5% efficiency and excellent thermal performance makes it an ideal choice for use in computing and telecommunication applications and can operate over an ambient temperature range of -40 ^{O}C ~ +85 ^{O}C.

Applications

Telecom/ Datacom

ARTESYN™
An Advanced Energy Company

Model Numbers

Standard	Output Voltage	Structure	Remote ON/OFF logic	RoHS Status
AVD85-48S3V3-6L	3.3Vdc	Open-frame	Negative	RoHS Directive(EU) 2015/863 (RoHS 3.0)
AVD85-48S3V3B-6L	3.3Vdc	Baseplate	Negative	RoHS Directive(EU) 2015/863 (RoHS 3.0)
AVD85-48S3V3TL	3.3Vdc	SMT, Open-frame	Negative	RoHS Directive(EU) 2015/863 (RoHS 3.0)

Ordering information

AVD85	-	48	S	3V3	P	B	-	6	L
①		②	③	④	⑤	⑥		⑦	⑧

①	Model series	AVD: high efficiency sixteenth brick series
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	6: 3.8mm±0.25mm S: SMT pin T: SMT pin and tape reel package
⑧	RoHS status	Y: RoHS, R5; L: RoHS Directive(EU) 2015/863 (RoHS 3.0)

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	$P_{O,max}$	-	-	82.5	W
Isolation Voltage[1]						
Input to outputs	Open frame module		-	-	1500	Vdc
Input to baseplate	Baseplate module		-	-	-	Vdc
Outputs to baseplate	Baseplate module		-	-	-	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		-0.3	-	5	Vdc
Humidity (non-condensing)						
Operating	All		-	-	95	%
Non-operating	All		-	-	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	$V_{IN,DC}$	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	A
No-load input current			-	0.04	-	A
Standby input current	Remote OFF		-	0.01	-	A
Recommended Input Fuse	Fast blow external fuse recommended		-	-	5	A
Input filter component values (C\L)			-	0\1	-	µF\µH
Recommended External Input Capacitance	Low ESR capacitor recommended	C_{IN}	-	100	-	µF
Input Reflected Ripple Current	Through 12µF inductor		-	-	40	mA
Operating Efficiency	T_A=25 °C $I_O = I_{O,max}$ $I_O = 50\% I_{O,max}$	η	- -	91.5 91.5	- -	% %

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=50%$I_{O,max}$	V_O	3.25	3.3	3.35	Vdc
Total Regulation		Over sample, line, load, temperature & life	V_O	3.2	3.3	3.4	Vdc
Output Voltage Line Regulation		All	%V_O	-	-	0.2	%
Output Voltage Load Regulation		All	%V_O	-	-	0.5	%
Output Voltage Temperature Regulation		All	%V_O	-	-	0.02	%/^{O}C
Output Voltage Trim Range		All	V_O	2.64	-	3.63	V
Output Ripple, pk-pk		20MHz bandwidth	V_O	-	85	120	mV_{PK-PK}
Output Current		All	I_O	0	-	25	A
Output DC current-limit inception[2]			I_O	27	-	37	A
V_O Load Capacitance[3]		All	C_O	220	470	4000	µF
V_O Dynamic Response	Peak Deviation	25% ~ 50% ~ 25% 50% ~ 75% ~ 50% load change slew rate = 0.1A/µs	±V_O T_s	- -	60 100	- -	mV µSec
	Settling Time[4]	25% ~ 50% ~ 25% 50% ~ 75% ~ 50% load change slew rate = 1A/µs	±V_O T_s	- -	150 100	- -	mV µSec
Turn-on transient	Rise time	I_O = I_{max}	T_{rise}	-	-	50	mS
	Turn-on delay time	I_O = I_{max}	$T_{turn-on}$	-	-	100	mS
	Output voltage overshoot	I_O = 0	%V_O	-	-	5	%
Switching frequency		All	f_{SW}	230	240	250	KHz
Remote ON/OFF control (positive logic)	Off-state voltage	All		-0.3	-	1.2	V
	On-state voltage	All		3.5	-	5	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 are recommended.
Note 4 - Recovery to within 1% Vo, nom

Output Specifications

Table 3. Output Specifications, con't:

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Remote ON/OFF control (Negative logic)	Off-state voltage	All		3.5	-	5	V
	On-state voltage	All		-0.3	-	1.2	V
Output over-voltage protection[5]		All	$\%V_O$	120	-	160	%
Output over-temperature protection[6]		All	T	-	109	-	^{O}C
Over-temperature hysteresis		All	T	-	10	-	^{O}C
+ Sense		All	%Vo	-	-	5	%
- Sense		All	%Vo	-	-	5	%
MTBF		Telcordia SR-332-2006; 80% load, 300LFM, 40 ^{O}C T_A		-	2.0	-	10^6 h

Note 5 - Hiccup: auto-restart when over-voltage condition is removed.
Note 6 - Auto recovery.

AVD85-48S3V3 Performance Curves

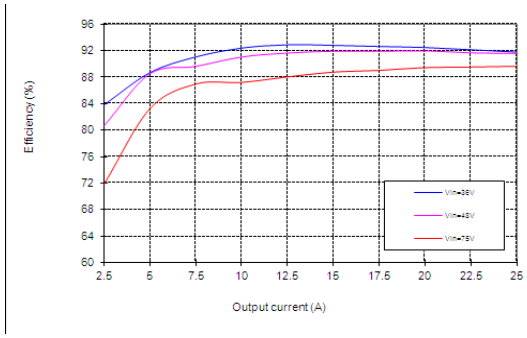


Figure 1: AVD85-48S3V3 Efficiency Curves @ 25 DegC, 200LFM
Io = 10% increment to 25A
Vo = 3.3V

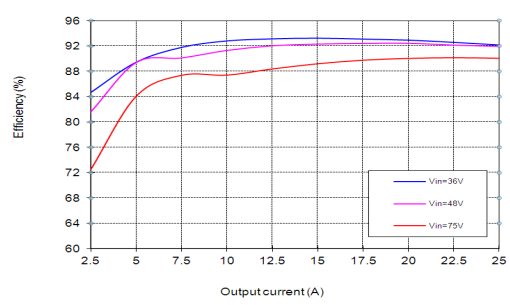


Figure 2: AVD85-48S3V3B Efficiency Curves @ 25 DegC, 200LFM
Io = 10% increment to 25A
Vo = 3.3V

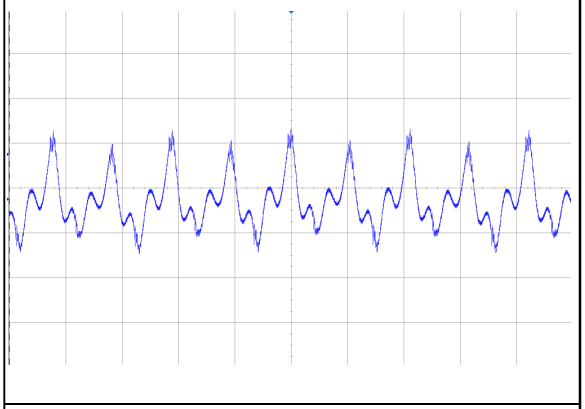


Figure 3: AVD85-48S3V3 Output Ripple and Noise
(2µs/div)
Ch 1: Vo (20mV/div)

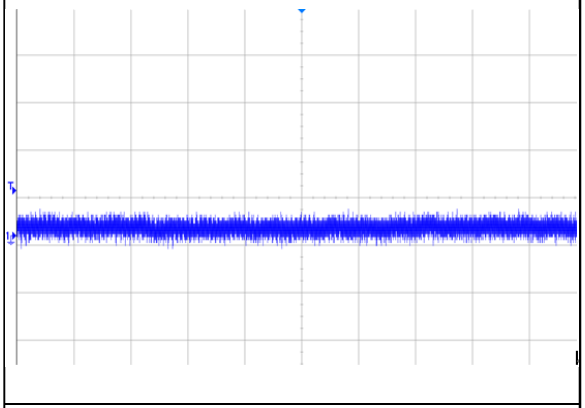


Figure 4: AVD85-48S3V3 Input Reflected Ripple Current Waveform
(50µs/div)
Ch 1: Iin (50mA/div)

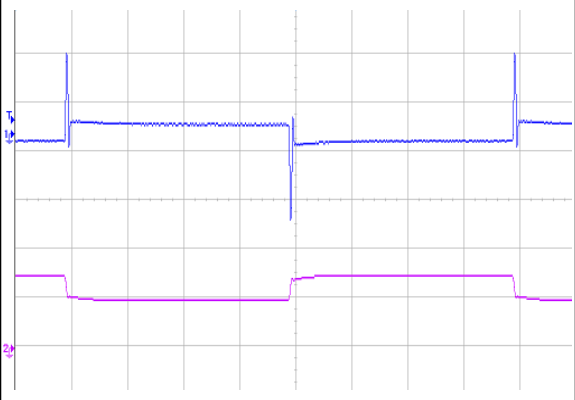


Figure 5: AVD85-48S3V3 Transient Response (1ms/div)
50%~75%~50% load change, 0.1A/µs slew rate
Ch 1: Vo (200mV/div) Ch 2: Io (10A/div)

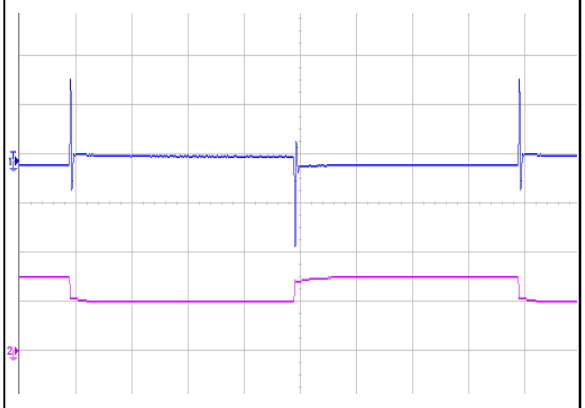


Figure 6: AVD85-48S3V3 Transient Response (1ms/div)
50%~75%~50% load change, 1A/µs slew rate
Ch 1: Vo (200mV/div) Ch 2: Io (10A/div)

AVD85-48S3V3 Performance Curves

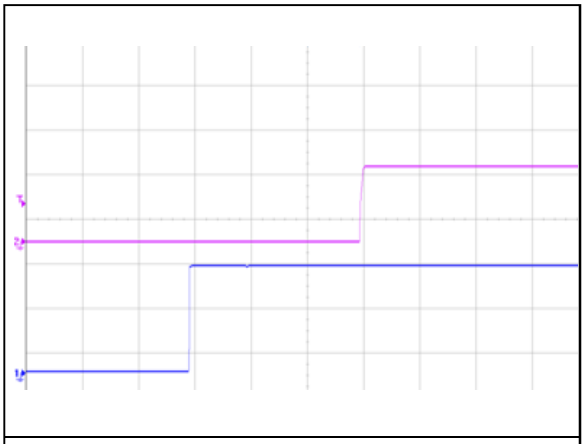


Figure 7: AVD85-48S3V3 Output Voltage Startup by Power On (20ms/div)
Ch 1: Vin (20V/div) Ch 2: Vo (2V/div)

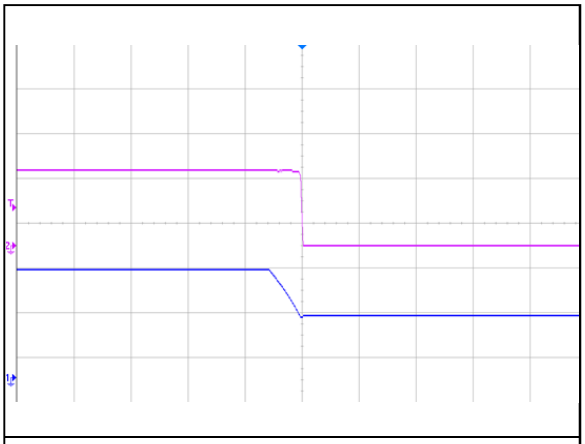


Figure 8: AVD85-48S3V3 Output Voltage Shut Down by Power Off (100ms/div)
Ch 1: Vin (20V/div) Ch 2: Vo (2V/div)

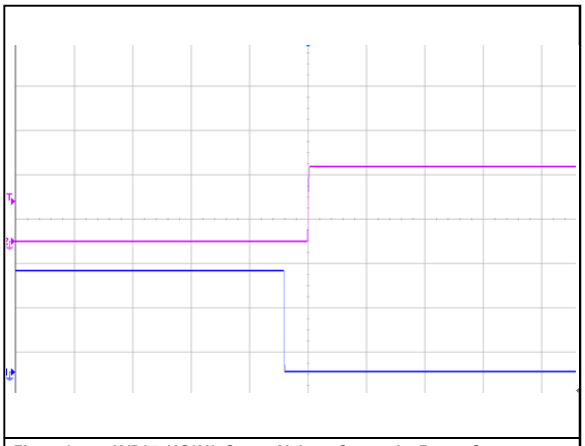


Figure 9: AVD85-48S3V3 Output Voltage Startup by Remot On (100ms/div)
Ch 1: Vin (2V/div) Ch 2: Vo (2V/div)

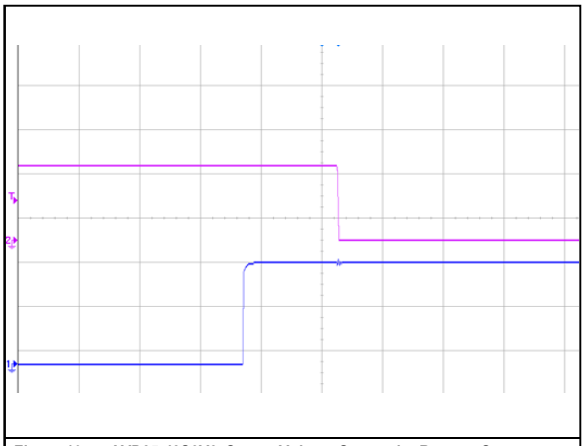
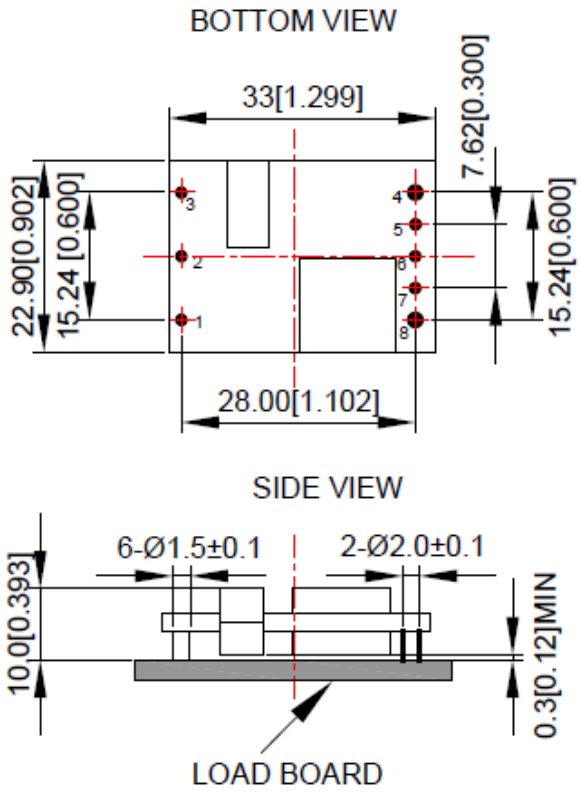


Figure 10: AVD85-48S3V3 Output Voltage Startup by Remote On (50ms/div)
Ch 1: Vin (2V/div) Ch 2: Vo (2V/div)

Mechanical Specifications

Mechanical Outlines – Open-Frame Module with SMT Pin

AVD85-48S3V3TL

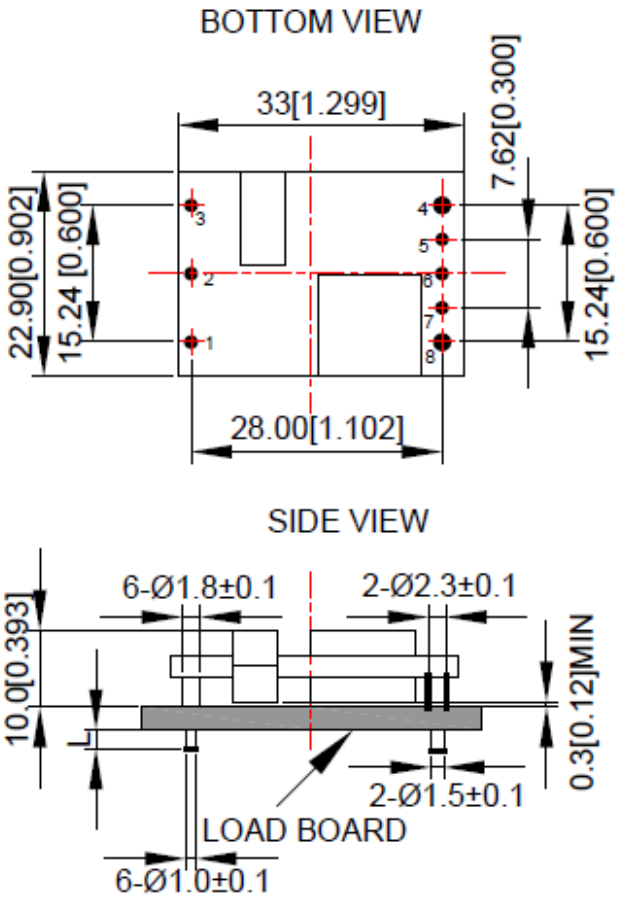


UNIT: mm[inch] BOTTOM VIEW: pin on upside

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

Mechanical Outlines – Open-Frame Module

AVD85-48S3V3-6L



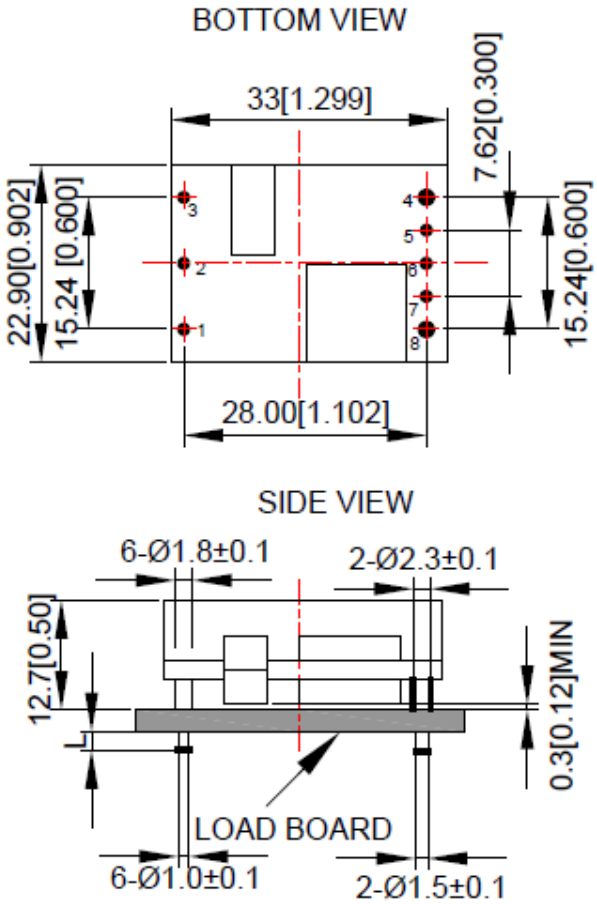
UNIT: mm[inch]

BOTTOM VIEW: pin on upside

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

Mechanical Outlines – Base plate Module

AVD85-48S3V3B-6L



UNIT: mm[inch]

BOTTOM VIEW: pin on upside

TOLERANCE: X.Xmm±0.5mm[X.XX in.±0.02in.]
X.XXmm±0.25mm[X.XXX 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	ON/OFF control
3	Vin-	Negative input voltage
4	Vo-	Negative output voltage
5	Sense-	Negative remote sense
6	Trim	Output voltage trim
7	Sense+	Positive remote sense
8	Vo+	Positive output voltage

Environmental Specifications

EMC Immunity

AVD85-48S3V3 series 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.

EMC Test Conditions

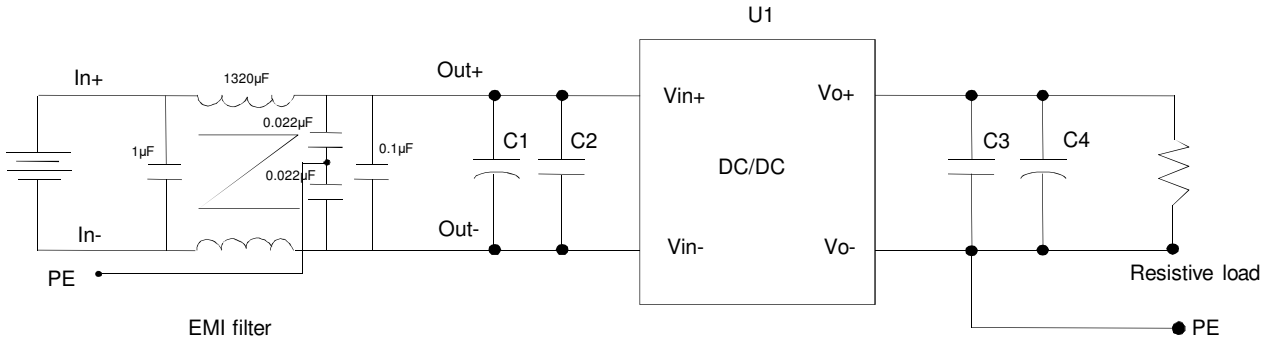


Figure 11 EMC Test Configuration

U1: Module to test, AVD85-48S3V3

C1 ~ C4: See Figure 16

Safety Certifications

The AVD100-48S05 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 AVD100-48S05 power supply system:

Document	File #	Description
UL/CSA 62368-1	E132002-A167-UL-X13	US and Canada Requirements
EN 62368-1	B 013890 3187 Rev. 00	European Requirements
CE	2415	CE Marking

Operating Temperature

The AVD85 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 of the DC/DC converter can be verified by measuring the temperatures at the test points shown in the Figure 12. The temperatures at these points should not exceed the maximal values in Table 5.

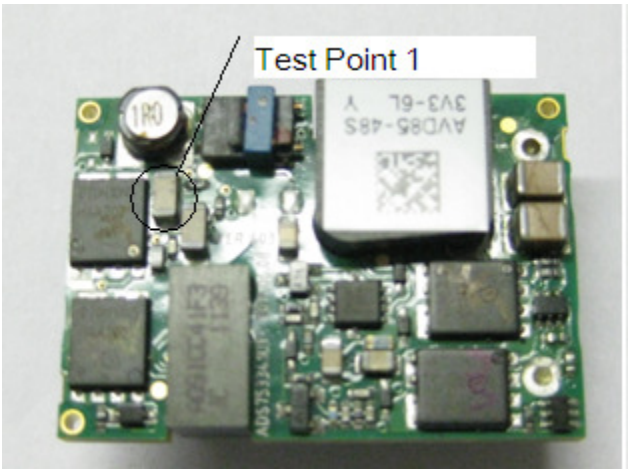


Figure 12 Temperature Test Point on FR-4 Board

Table 6. Temperature limit of the test points

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

For a typical application, Figure 13 shows the derating of output current vs. ambient air temperature at different air velocity.

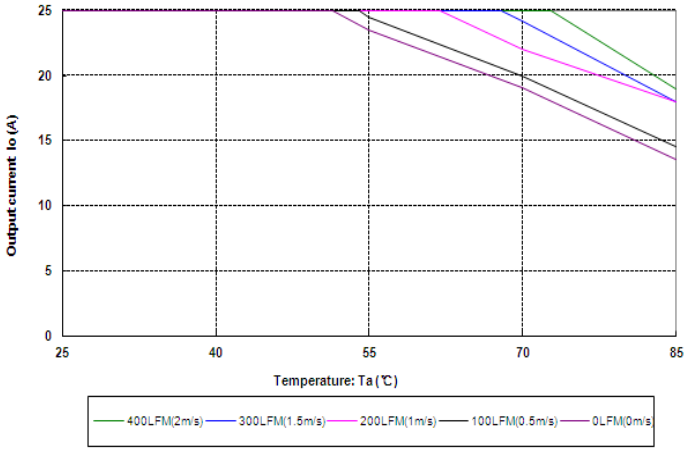
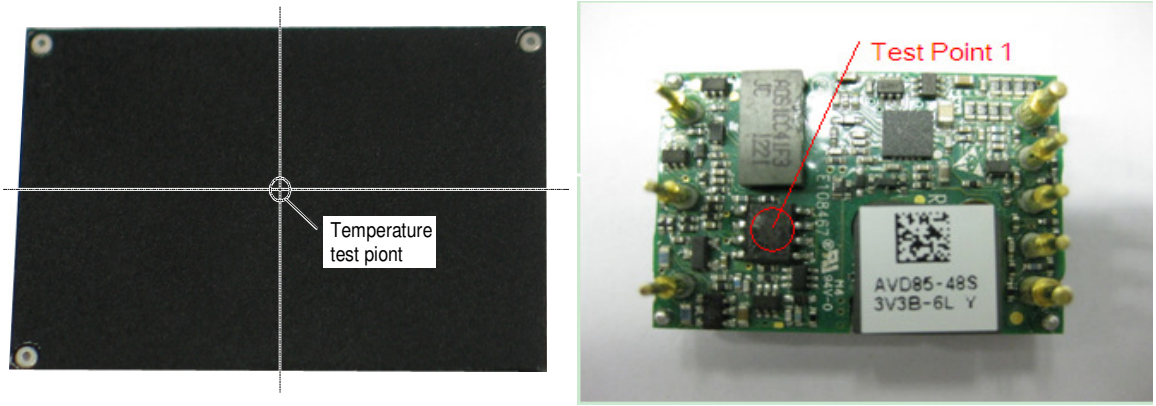


Figure 13 Output Power Derating, 48Vin (air flowing across the converter from pin 3 to pin 1)

Thermal Considerations – Base plate module

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 temperatures at the test points shown in the Figure 14. The temperatures at these points should not exceed the maximal values in Table 6.



Temperature test point on base plate Temperature test point on FR-4 board

Figure 14 Temperature Test Point

Table 7. Temperature limit of the test points

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

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

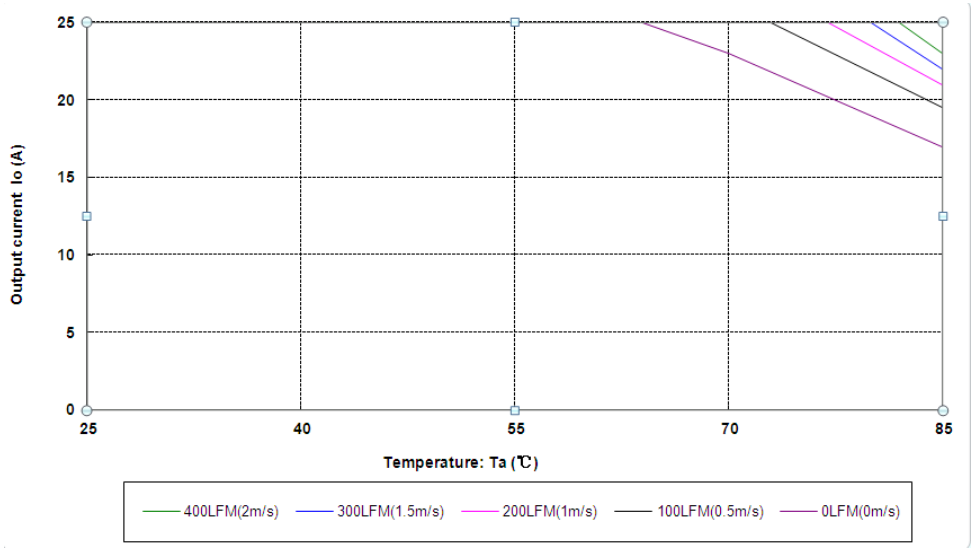


Figure 15 Output Power Derating, 48Vin (air flowing across the converter from pin 1 to pin 4)

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

Application Notes

Typical Application

Below is the typical application of the AVD85-48S3V3 series power supply.

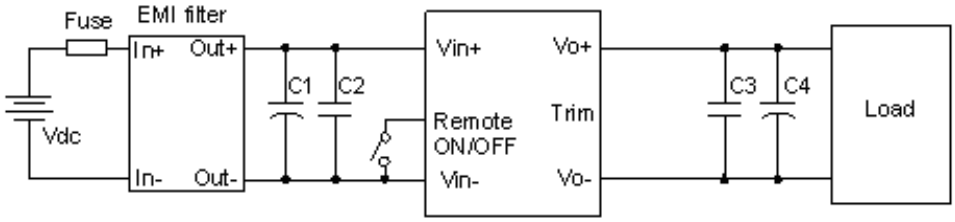


Figure 16 Typical Application

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

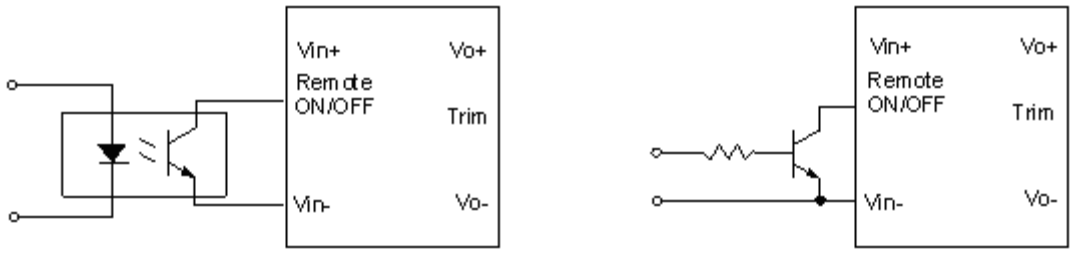
C2, C3: 1μF/100V X7R ceramic capacitor, P/N: C3225X7R2A105KT0L0U (TDK) or equivalent caps

C4: 470μF electrolytic capacitor, P/N: UPM1A471MHD (Nichicon) or equivalent caps

Fuse: External fast blow fuse with a rating of 5A. The recommended fuse model is 0314005.P from LITTLEFUSE.

Remote ON/OFF

Negative remote ON/OFF logic is available in AVD85-48S3V3. 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 is highly recommended as shown in Figure 17.



Isolated remote ON/OFF circuit

Non-isolated remote ON/OFF circuit

Figure 17 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.

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

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

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

△: Output e rate against nominal output voltage.

V_{nominal} : Nominal output voltage.

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

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

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

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 below figures.

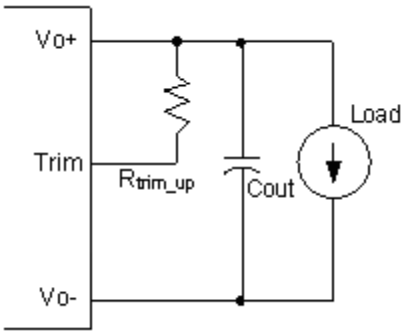


Figure 18 Trim Up

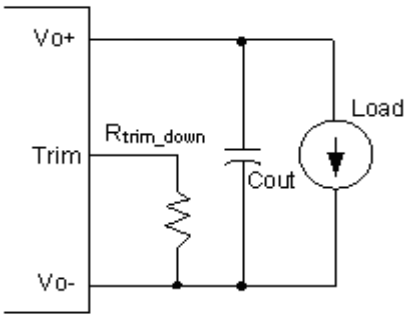


Figure 19 Trim Down

Input Ripple & Output Ripple & Noise Test Configuration

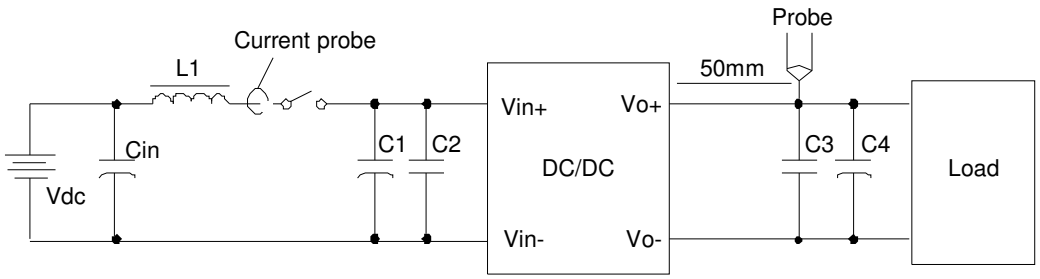


Figure 20 Input Ripple & Output Ripple & Noise Test Configuration

Vdc: DC power supply

L1: 12μH

Cin: 220μF/100V typical

C1 ~ C4: See Figure 16

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.

Over-Temperature Protection Test Points

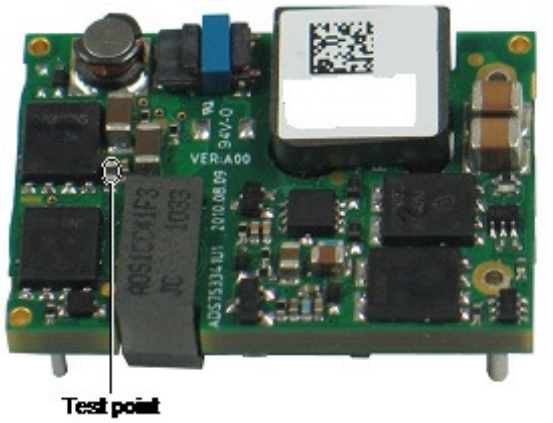


Figure 21 Open-frame OTP Test Point

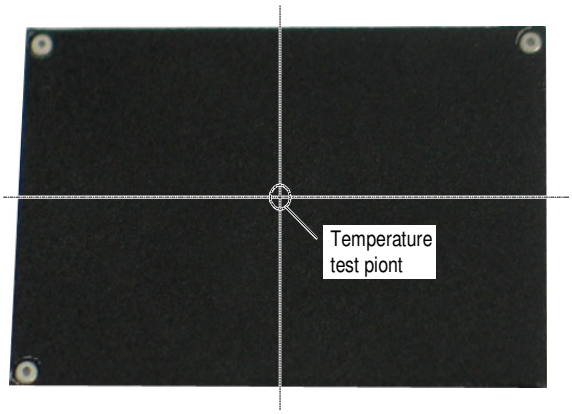


Figure 22 Base Plate OTP Test Point

Soldering

The product is intended for standard manual or wave soldering.

	Product Requirement	Product Name
R6	Wave soldering	AVD85-48S3V3B-6L AVD85-48S3V3-6L AVD85-48S3V3TL

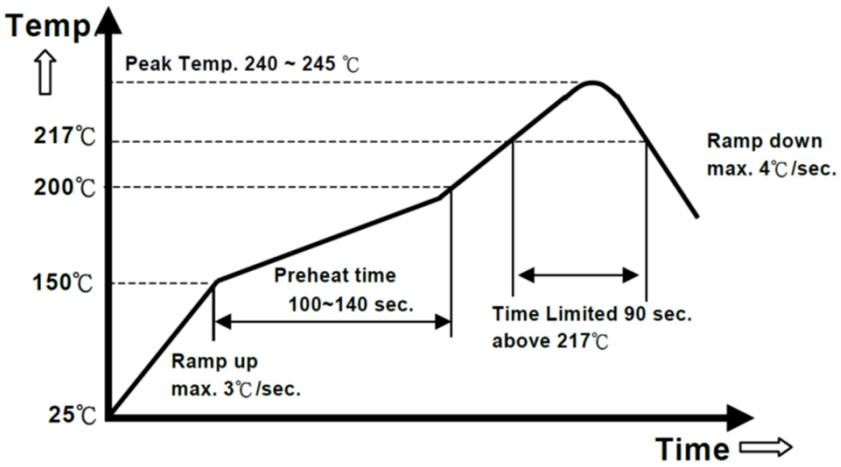
When wave soldering is used, the temperature on pins is specified to maximum 260 ^{O}C for maximum 7s.

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.

The below products are intended for standard reflow soldering.

	Product Requirement	Product Name
R6	Reflow soldering	AVD85-48S3V3-6L AVD85-48S3V3TL

When reflow soldering is used, Please refer to following fig for recommended temperature profile parameters.



Package Information

Package type

Moisture sensitivity level 3, Moisture Barrier Bags

Minimal Package QTY

192 PCS

Package disassembly

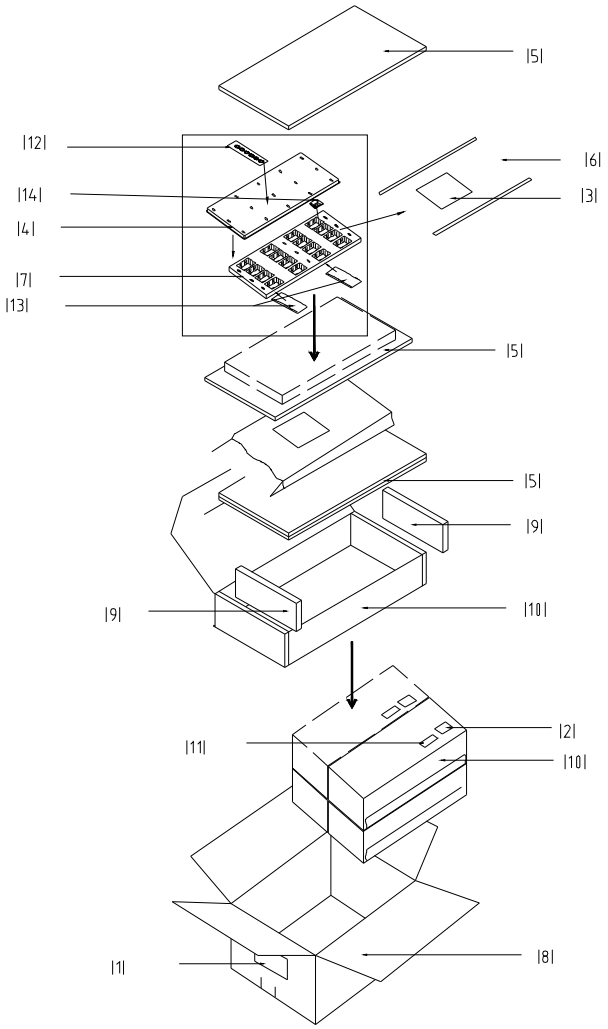
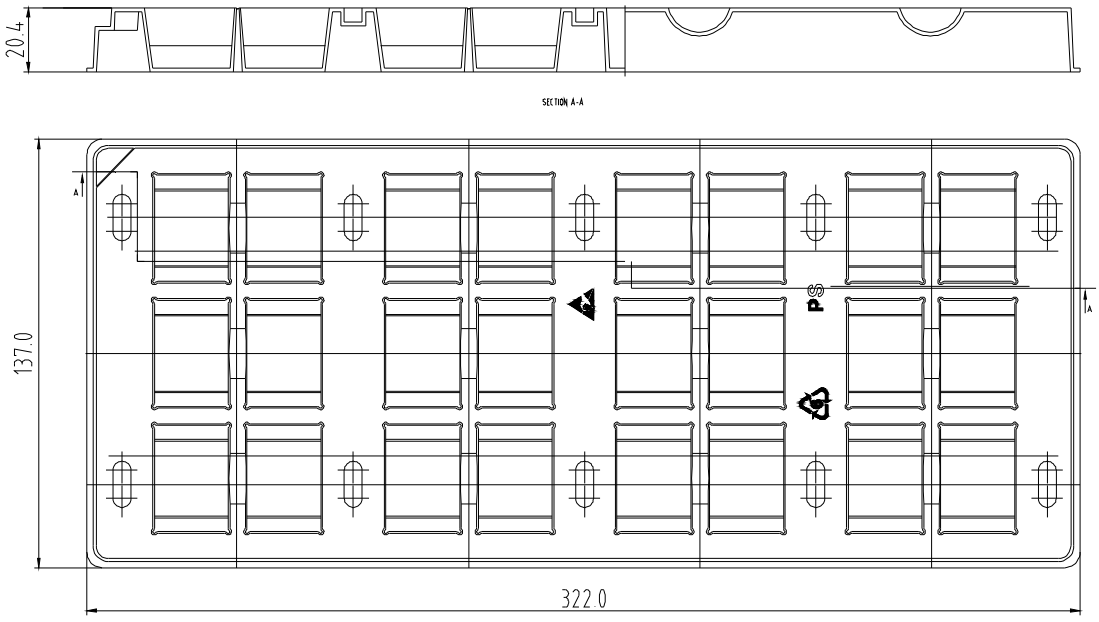


Figure 23 Package Disassembly

Table 8. Assemblies description

No.	Description
1	Shipping label
2	Moistureproof identification label
3	Moistureproof caution label
4	Tray cover
5	Anti-static PE foam 1
6	Moisture barrier bag
7	Tray
8	Shipping carton
9	Anti-static PE foam 2
10	Inner box
11	Model barcode label
12	Humidity indicating card
13	Desiccant
14	Model

Package tray information



Record of Revision and Changes

Issue	Date	Description	Originators
1.0	08.21.2014	First Issue	S. Yang
1.1	10.21.2014	Add the “condition”	S. Yang
1.2	10.25.2016	Update the Mechanical drawing	K. Wang
1.3	12.06.19	Update soldering	K.Ma
1.4	02.27.2020	Update RoHS information	V.Guo
1.5	06.04.2020	Update safety cert from 60950 to 62368	K.Ma

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