

AVD100-48S05

100 Watts

Sixteenth-brick Converter

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



Special Features

- Delivering up to 20A output
- Ultra-high efficiency 93.5% typ. at 60% load
- Wide input range: 36V ~ 75V
- Excellent thermal performance
- No minimum load requirement
- Basic isolation
- High power density
- Low output noise
- Reflow soldering-able
- RoHS Directive(EU) 2015/863 (RoHS 3.0)

Safety

IEC/EN/UL/CSA 60950
2006/95/EEC, 93/68/EEC
UL/TUV
UL94,V-0

Product Descriptions

The AVD100-48S05 is a single output DC/DC converter with standard sixteenth-brick form factor and pin configuration. It delivers up to 20A output current with 5V output. Above 93.5% efficiency and excellent thermal performance makes it an ideal choice to supply power in datacom and telecommunication applications and can operate over an ambient temperature range of -40 °C ~ +85 °C.

Applications

Telecom/ Datacom

Model Numbers

Standard	Output Voltage	Structure	Remote ON/OFF logic	RoHS Status
AVD100-48S05TL	5Vdc	Open-frame	Negative	RoHS Directive(EU) 2015/863 (RoHS 3.0)
AVD100-48S05-6L	5Vdc	Open-frame	Negative	RoHS Directive(EU) 2015/863 (RoHS 3.0)
AVD100-48S05B-6L	5Vdc	Baseplate	Negative	RoHS Directive(EU) 2015/863 (RoHS 3.0)

Ordering information

AVD100	-	48	S	05	P	B	-	T	L
①		②	③	④	⑤	⑥		⑦	⑧

①	Model series	AVD: Standard sixteenth-brick series, 100: 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	05: 5V output
⑤	Remote ON/OFF logic	Default: negative logic; P: positive logic
⑥	Baseplate	B: with baseplate; default: open-frame
⑦	Pin length	T:SMT, 6: 3.8mm Through Hole
⑧	RoHS status	Y: Rohs, R5; L: 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 Non-operating -100mS	All	$V_{IN,DC}$	-	-	80	Vdc
	All		-	-	100	Vdc
Maximum Output Power	All	$P_{O,max}$	-	-	100	W
Isolation Voltage ¹ Input to outputs	All		-	-	2250	Vdc
Ambient Operating Temperature	All	T_A	-40	-	+85	°C
Storage Temperature	All	T_{STG}	-55	-	+125	°C
Voltage at remote ON/OFF pin	All		-0.3	-	5	Vdc
Humidity (non-condensing) Operating Non-operating	All		-	-	95	%
	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 ($I_O = I_{O,max}$)	$V_{IN,DC} = 36V_{DC}$	$I_{IN,max}$	-	-	4	A
No Load Input Current (V_O On, $I_O = 0A$, $I_{VSB} = 0A$)	$V_{IN,DC} = 36V_{DC}$	I_{IN,no_load}	-	0.04	-	A
Standby Input Current	$V_{IN,DC} = 36V_{DC}$	$I_{IN,standby}$	-	0.01	-	A
Recommended Input Fuse	Fast blow external fuse recommended		-	-	5	A
Recommended External Input Capacitance	Low ESR capacitor recommended	C_{IN}	-	100	-	uF
Input Reflected Ripple Current	Through 12uH inductor			40	-	mA
Input filter component values (C\L)	Internal values		-	0\1.2	-	uF\uH
Operating Efficiency	$T_A = 25\text{ }^\circ\text{C}$ $I_O = I_{O,max}$ $I_O = 60\% I_{O,max}$	η	-	92.5	-	%
			-	93.5	-	%

Note 1 - $T_a = 25\text{ }^\circ\text{C}$, airflow rate = 300 LFM, $V_{in} = 48V_{dc}$, nominal V_{out} 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	4.92	5.00	5.08	Vdc	
Total Regulation	Over sample, line, load, temperature & life	V_O	4.9	5	5.1	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	$\%/^{\circ}C$	
Output Voltage Trim Range	All	V_O	4	-	5.5	V	
Output Ripple, pk-pk	Measure with a 1uF ceramic capacitor in parallel with a 10uF tantalum capacitor, 0 to 20MHz bandwidth	V_O	-	120	-	mV_{PK-PK}	
Output Current	All	I_O	0	-	20	A	
V_O Load Capacitance ²	All	C_O	220	1000	10000	μF	
V_O Dynamic Response	Peak Deviation Settling Time	50%~75%~50% 25% load change slew rate = 0.1A/us	$\pm V_O$	-	-	150	mV
		50%~75%~50% 25% load change slew rate = 1A/us	T_s	-	-	200	μSec
Output DC current-limit inception ³			22	-	34	A	
Turn-on transient	Rise time	$I_O = I_{max}$	T_{rise}	-	-	50	mS
	Turn-on delay time	$I_O = I_{max}$	$T_{turn-on}$	-	3	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	
Remote ON/OFF control (Negative logic)	Off-state voltage	All	3.5	-	5	V	
	On-state voltage	All	-0.3	-	1.2	V	

Note 1 - $T_a = 25^{\circ}C$, airflow rate = 300 LFM, $V_{in} = 48V_{dc}$, nominal V_{out} unless otherwise noted.

Note 2 - High frequency and low ESR is recommended.

Note 3 - Hiccup: auto-restart when over-current condition is removed

Output Specifications

Table 3. Output Specifications, con't:

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output over-voltage protection ³	All	$\%V_O$	116	-	150	%
Output over-temperature protection ⁴	All	T	110	125	135	°C
Over-temperature hysteresis	All	T	5	-	-	°C
Output voltage remote sense range	All	V_o	-	-	0.5	V
MTBF	Telcordia SR-332-2006; 80% load, 300LFM, 40 °C T _A		-	2.0	-	10 ⁶ h

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

Note 4 - Auto recovery.

AVD100-48S05 Performance Curves

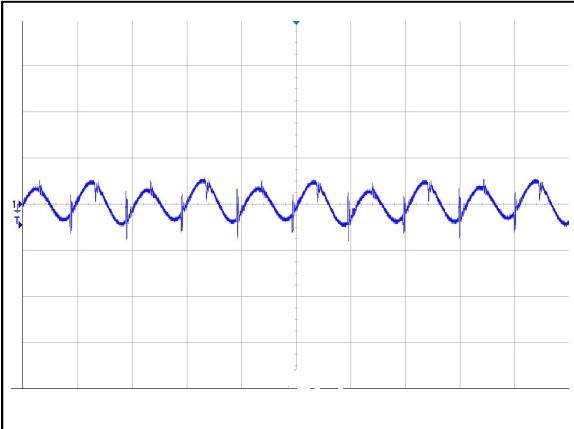


Figure 1: AVD100-48S05 Input Reflected Ripple Current Waveform
Ch 1: Iin (2uS/div, 50mA/div)

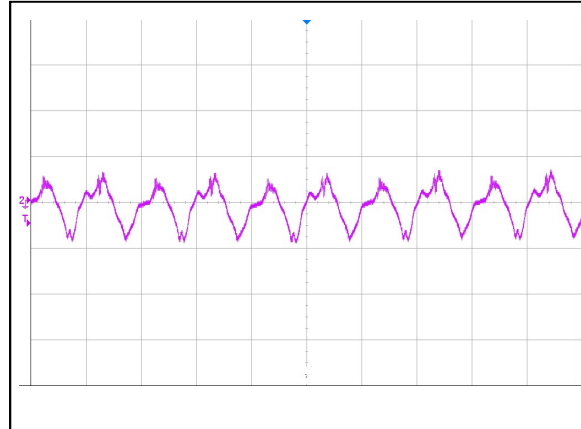


Figure 2: AVD100-48S05 Ripple and Noise Measurement
Ch 1: Vo (2uS/div, 20mV/div)

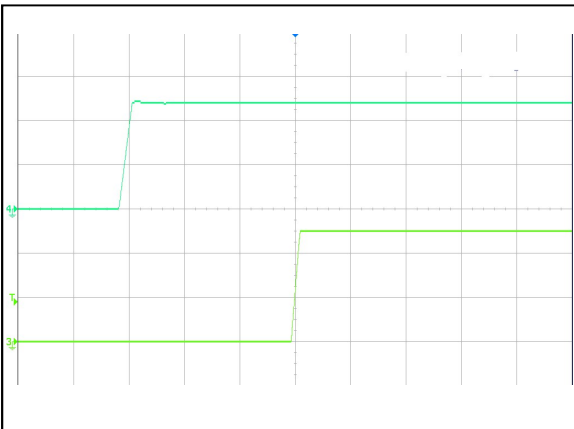


Figure 3: AVD100-48S05 Output Voltage Startup Characteristic (20mS/div)
Ch 1: Vin (20V/div) Ch 2: Vo (2V/div)

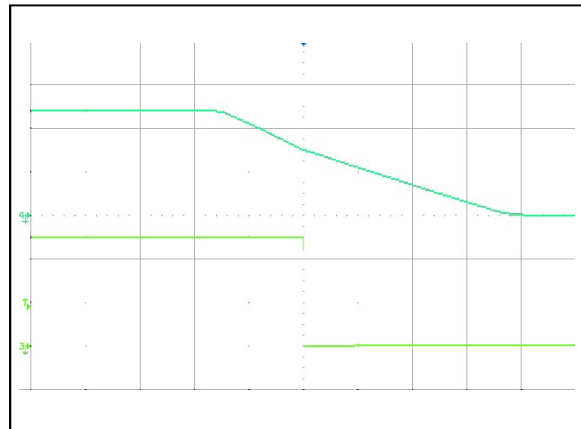


Figure 4: AVD100-48S05 Turn Off Characteristic (20mS/div)
Ch 1: Vin (20V/div) Ch 2: Vo (2V/div)

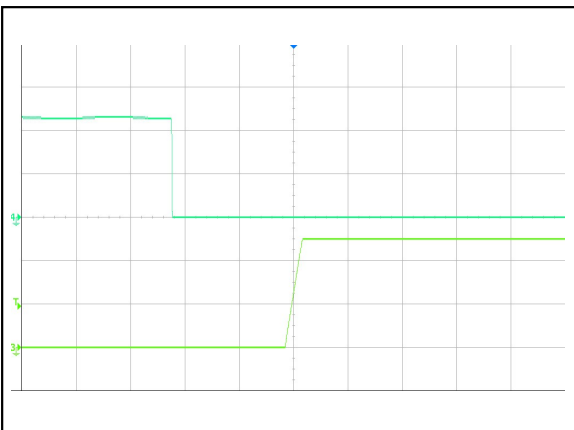


Figure 5: AVD100-48S05 Remote ON Waveform (10mS/div)
Ch 1: Remote ON (2V/div) Ch 3: Vo (2V/div)

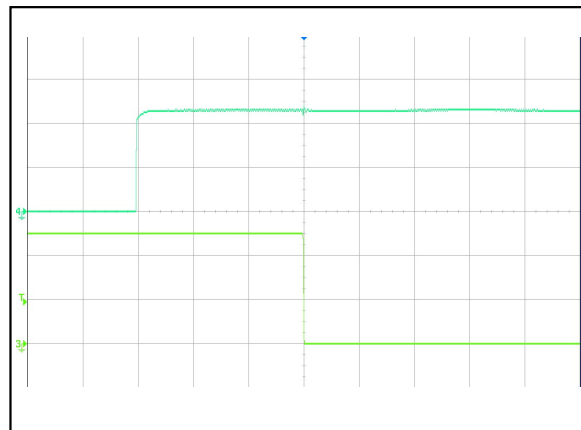


Figure 6: AVD100-48S05 Remote OFF Waveform (5mS/div)
Ch 1: Remote OFF (2V/div) CH3: Vo (2V/div)

AVD100-48S05 Performance Curves

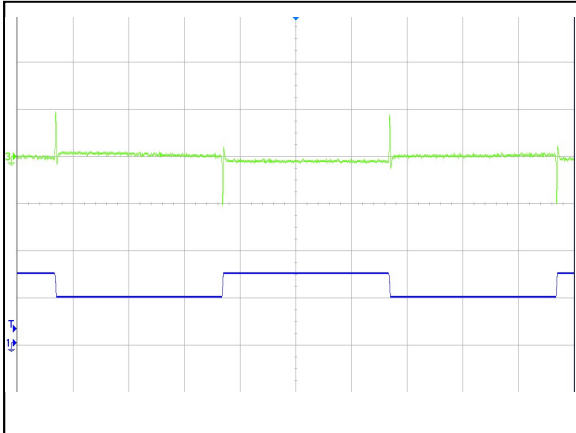


Figure 7: AVD100-48S05 Transient Response (1mS/div)
 50%-75%-50% load change, 0.1A/uS slew rate
 Ch 1: Io (5A/div) Ch 3: Vo (20mV/div)

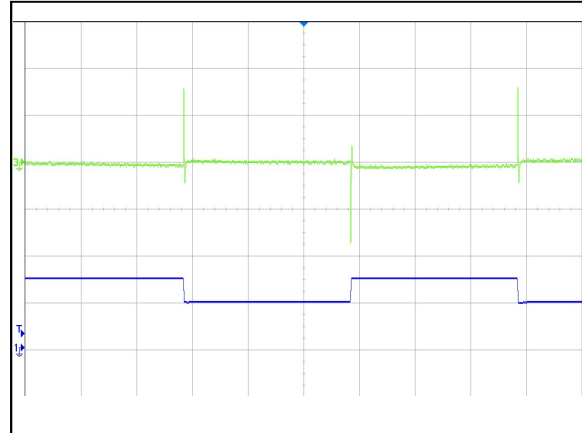


Figure 8: AVD100-48S05 Transient Response (1mS/div)
 50%-75%-50% load change, 1A/uS slew rate
 Ch 1: Io (5A/div) Ch 3: Vo (20mV/div)

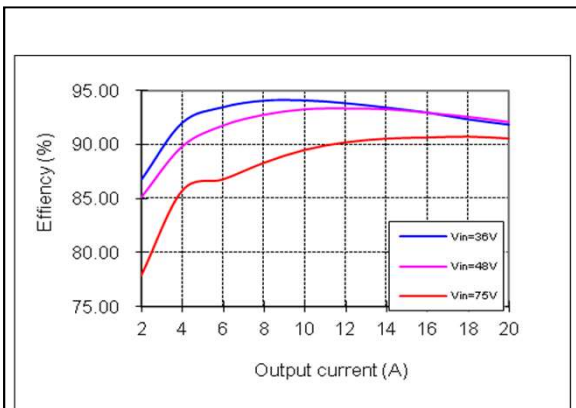


Figure 9: AVD100-48S05 Efficiency Curves @ 25 °C, 200LFM, Vo=5V
 Loading: Io = 10% increment to 20A

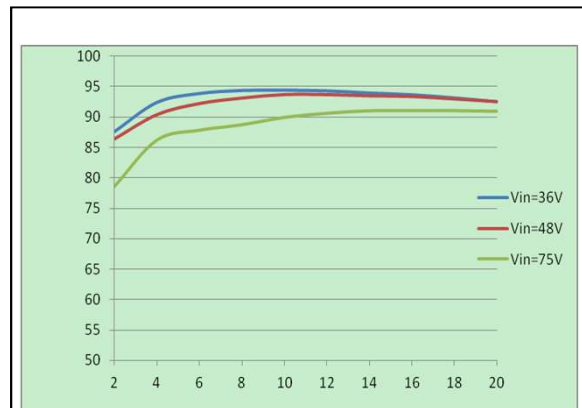
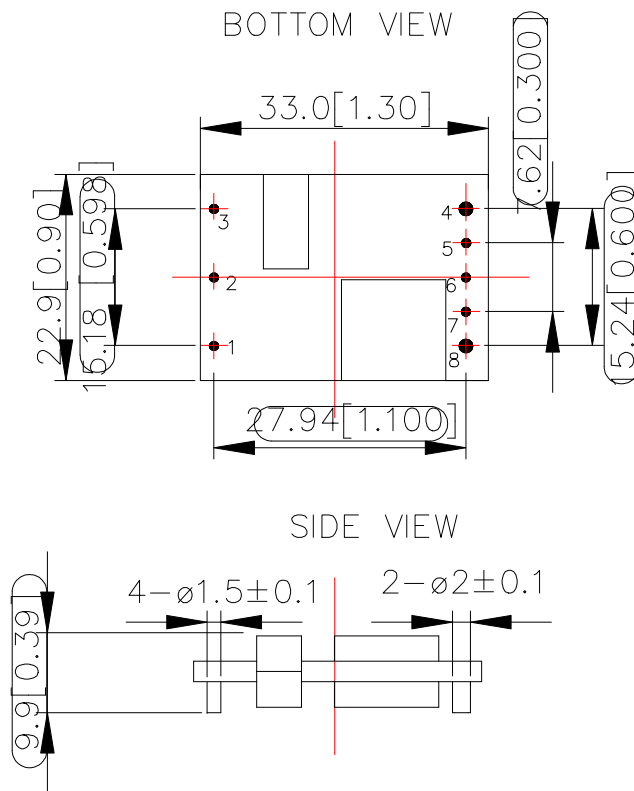


Figure 10: AVD100-48S05B Efficiency Curves @ 25 °C, 200LFM, Vo=5V
 Loading: Io = 10% increment to 20A

Mechanical Specifications

Mechanical Outlines – Surface Mounted Module

AVD100-48S05TL



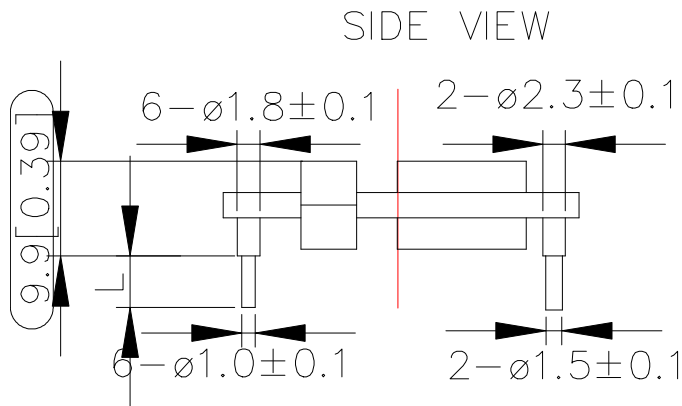
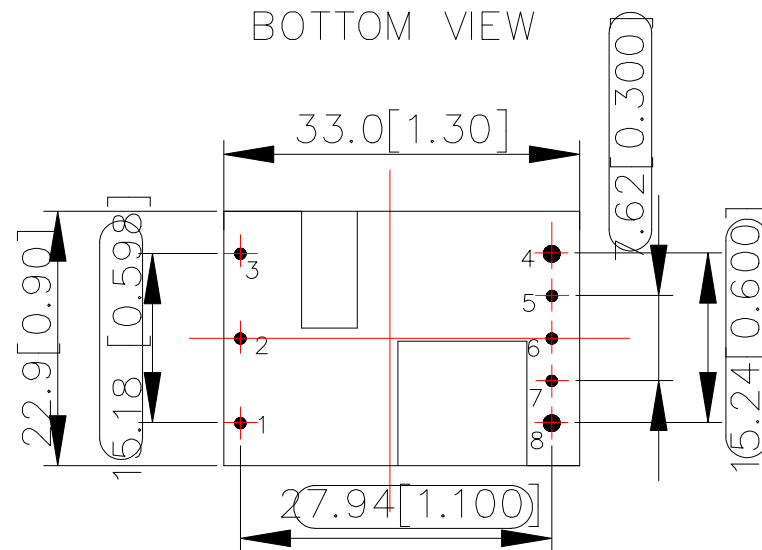
UNIT: mm[inch]

TOLERANCE: X.Xmm \pm 0.5mm[X.XX in. \pm 0.02in.]

X.XXmm \pm 0.25mm[X.XXX in. \pm 0.01in.]

Mechanical Outlines – Open Frame Module

AVD100-48S05-6L

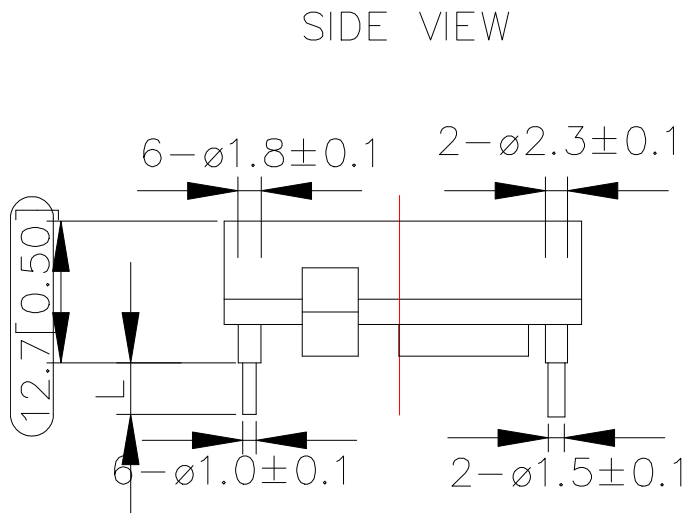
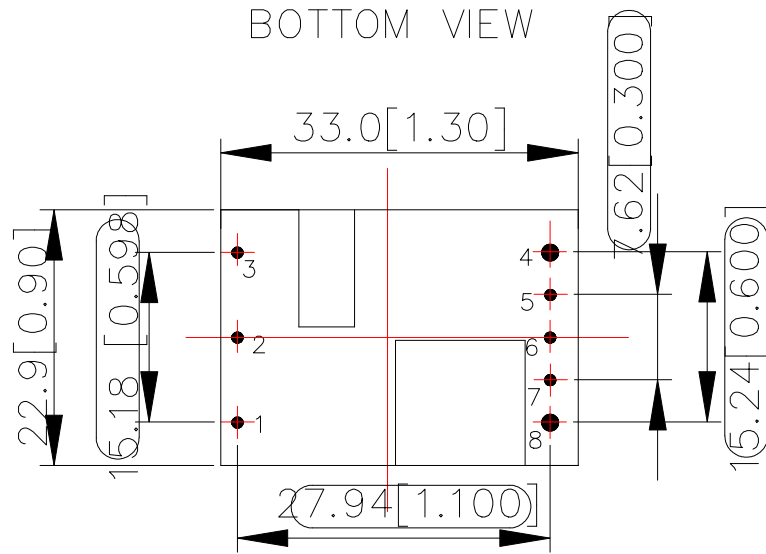


UNIT: mm[inch]=3.80±0.25mm

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

Mechanical Outlines – Baseplate Module

AVD100-48S05B-6L



UNIT: mm[inch]=3.80±0.25mm

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	4.6mm ± 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 terminal
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

AVD100-48S05 power supply is designed to meet the following EMC immunity specifications:

Table 4. Environmental Specifications:

Document	Description	Criteria
EN55022 DC input port, Class A Limits	Conducted Emission	/
IEC/EN 61000-4-2 Enclosure Port, Level 3	Immunity to Electrostatic Discharge	B
IEC/EN 61000-4-6, DC input port, Level 2	Immunity to Continuous Conducted Interference	A
IEC/EN 61000-4-4 DC input port, Level3	Immunity to Electrical Fast Transient	B
IEC/EN 61000-4-5 DC input port Line to Ground(earth): 600V Line to Line: 600V	Immunity to Surges	B
EN61000-4-29 DC input port	Immunity to Voltage Dips and Short Interruptions and Voltage Variations	B

Criterion A: Normal performance during and after test.

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

EMC Test Conditions

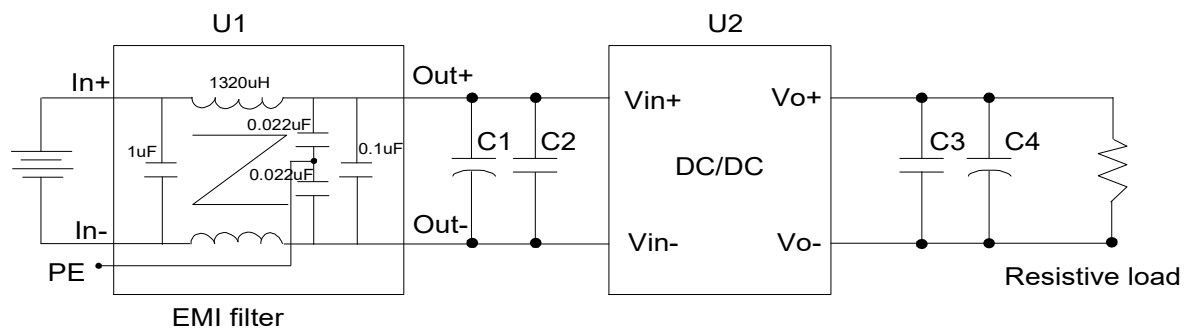


Figure 11 EMC test configuration

U1: Input EMC filter

U2: Module to test, AVD100-48S05

C1: 100µF/100V electrolytic capacitor; P/N: UPW2A101MHD (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

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 60950		US and Canada Requirements
EN60950		European Requirements
IEC60950		International Requirements
CE		CE Marking

Operating Temperature

The AVD100 series power supplies will start and operate within stated specifications at an ambient temperature from -40 °C to 85 °C under all load conditions. The storage temperature is -55 °C to 125 °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.

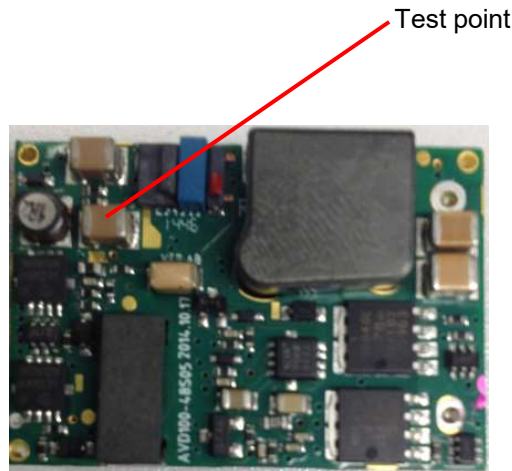


Figure 12 Temperature test point

Table 6. Temperature limit of the test point

Test Point	Temperature Limit
Test point	115 °C

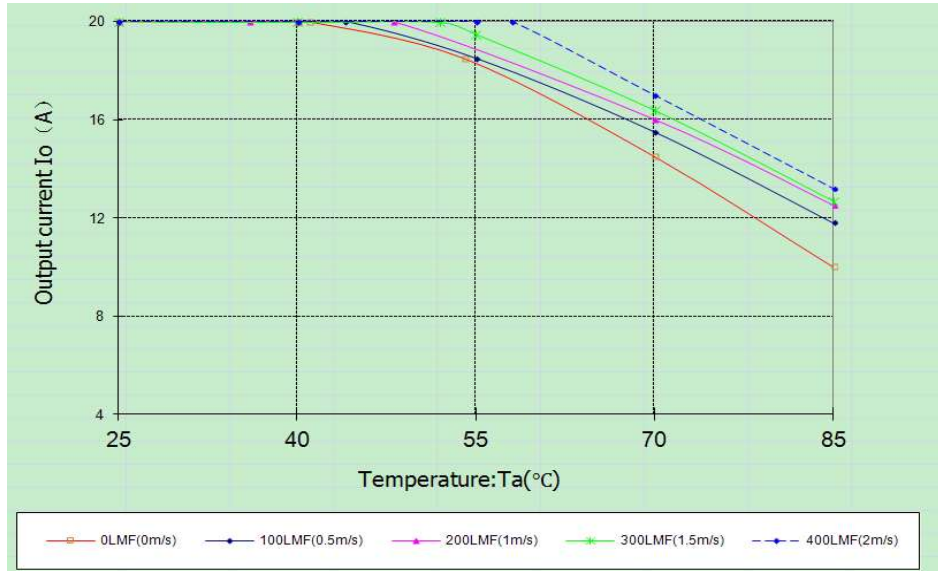


Figure 13 Derating curve

Thermal Considerations –Baseplate 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 temperature at the test points as shown in the Figure 14. The temperature at these points should not exceed the max values in the table 7.

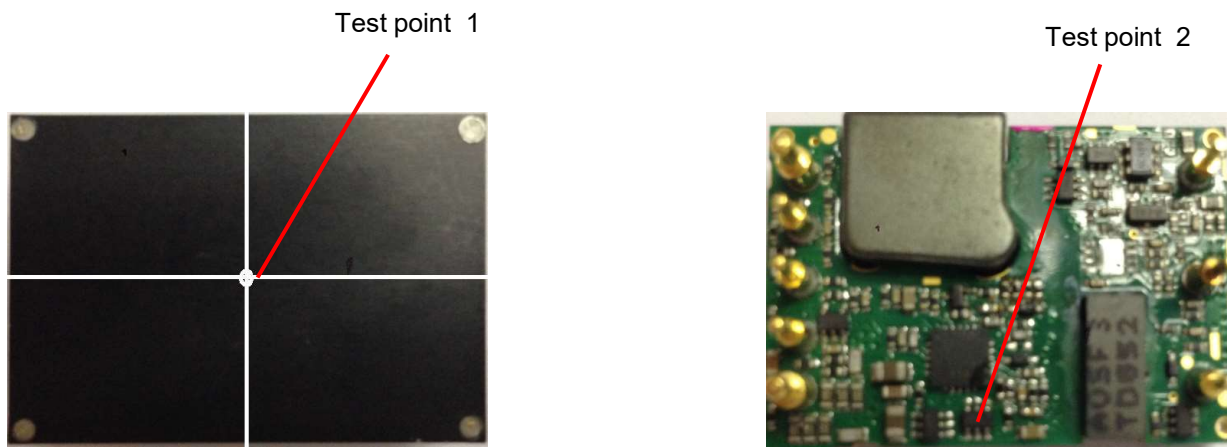


Figure 14 Temperature test points

Table 7. Temperature limit of the test point

Test Point	Temperature Limit
Test point 1	108 °C
Test point 2	113 °C

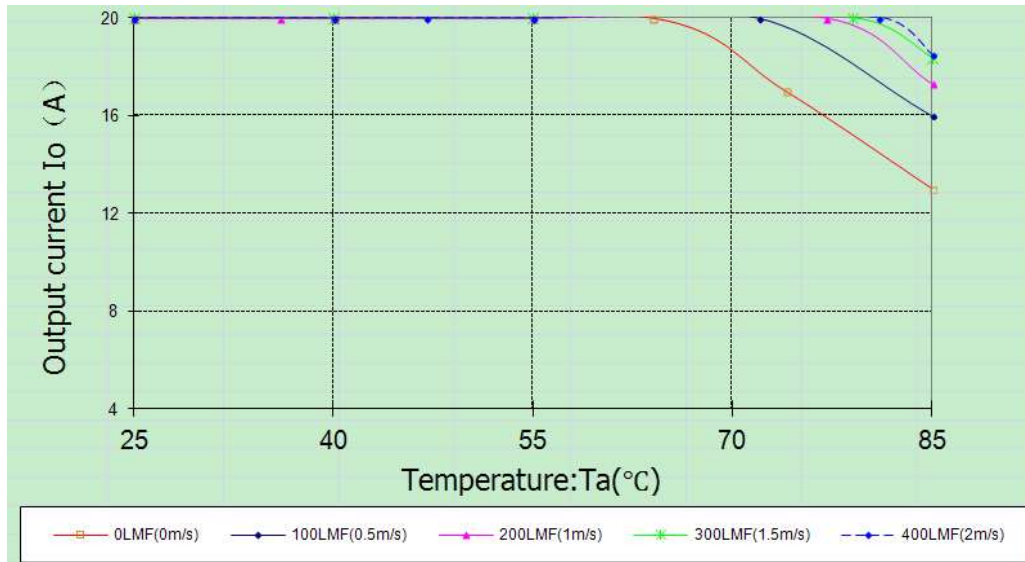
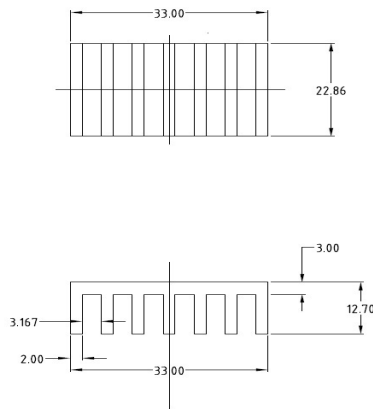


Figure 15 Output power derating, 48Vin, air flowing across the converter from pin 3 to pin 1



Heatsink Mechanical diagram

Qualification Testing

Parameter	Unit (pcs)	Test condition
Halt test	4-5	$T_{a,min} - 10\text{ }^{\circ}\text{C}$ to $T_{a,max} + 10\text{ }^{\circ}\text{C}$, $5\text{ }^{\circ}\text{C}$ step, $V_{in} = \text{min to max}$, $0 \sim 105\%$ load
Vibration	3	Frequency range: $5\text{Hz} \sim 20\text{Hz}$, $20\text{Hz} \sim 200\text{Hz}$, A.S.D: $1.0\text{m}^2/\text{s}^3$, -3db/oct , axes of vibration: X/Y/Z. Time: 30min/axis
Mechanical Shock	3	30g , 6ms , 3axes , 6directions , 3time/direction
Thermal Shock	3	$-40\text{ }^{\circ}\text{C}$ to $100\text{ }^{\circ}\text{C}$, unit temperature 20cycles
Thermal Cycling	3	$-40\text{ }^{\circ}\text{C}$ to $55\text{ }^{\circ}\text{C}$, temperature change rate: $1\text{ }^{\circ}\text{C/min}$, cycles: 2cycles
Humidity	3	$40\text{ }^{\circ}\text{C}$, $95\%\text{RH}$, 48h
Solder Ability	15	IPC J-STD-002C-2007

Application Notes

Typical Application

Below is the typical application of the AVD100-48S05 series power supply.

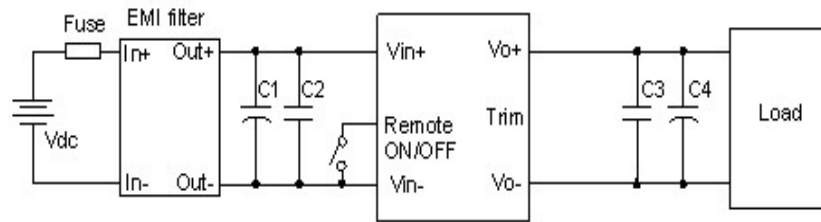


Figure 16 Typical application

C1: 100 μ F/100V electrolytic capacitor; P/N: UPW2A101MHD (Nichicon) or equivalent caps

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

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

Fuse: External fast blow fuse with a rating of 5A. The recommended fuse model is 0451005.MRSN from LITTLEFUSE.

Remote ON/OFF

Negative remote ON/OFF logic is available in AVD100-48S05. The logic is CMOS and TTL compatible.

The voltage between pin Remote ON/OFF and pin V_{in-} must not exceed the range listed in table "Feature characteristics" to ensure proper operation. The external Remote ON/OFF circuit is highly recommended as shown in figure 17.

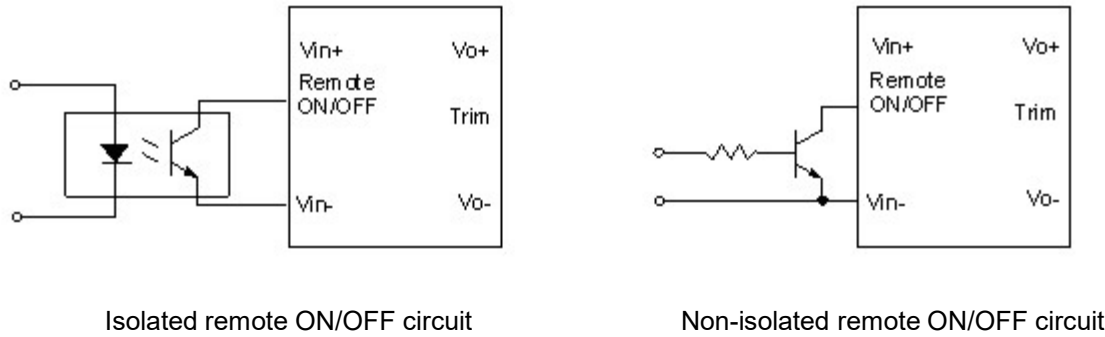


Figure 17 External Remote ON/OFF circuit

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.

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

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

Δ : Output error rate against nominal output voltage.

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

V_{nom} : Nominal output voltage.

For example, to get 5.5V output, the trimming resistor is

$$\Delta = \frac{100 \times (V_{nom} - V_0)}{V_{nom}} = \frac{100 \times (5.5 - 5)}{5} = 10$$

$$R_{adj-up} = \frac{5.1 \times 5 \times (100 + 10)}{1.225 \times 10} - \frac{510}{10} - 10.2 = 167.78(K\Omega)$$

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

Internal side

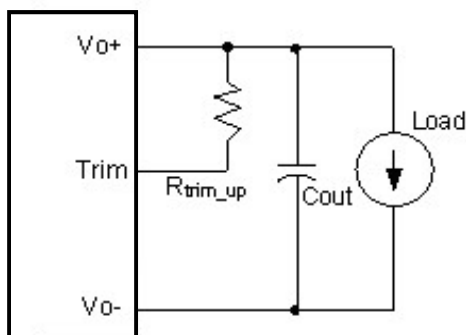


Figure 18 Trim up

Internal side

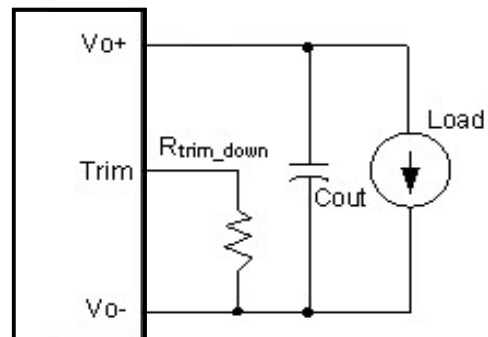


Figure 19 Trim down

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

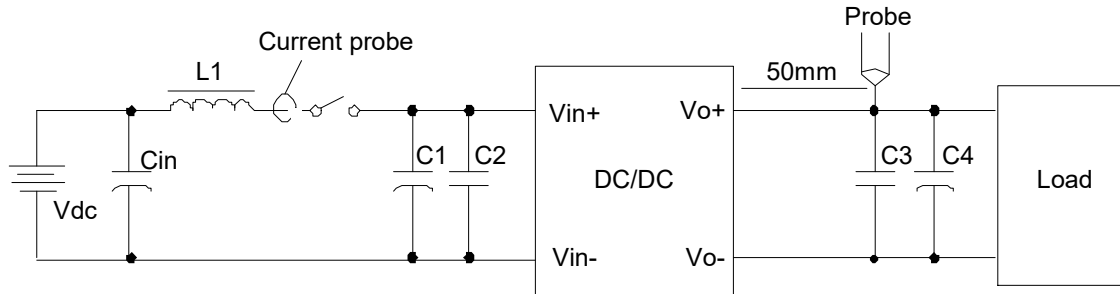


Figure 20 Input ripple & inrush current output ripple & noise test configuration

V_{dc}: DC power supply

L1: 12uH

C_{in}: 220uF/100V typical

C1: 100μF/100V electrolytic capacitor; P/N: UPW2A101MHD (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

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

Weight

The AVD100-48S05-6L (Open Frame) weight is 19g.maximum.(16g.minmum)

The AVD100-48S05B-6L (Baseplate) weight is 27.7g.maximum.(22.7g.minmum)

The AVD100-48S05TL (Open-frame) weight is 17.6g.maximum.(14.4g.minmum)

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 °C for maximum 7s.

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

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

Assembly

The maximum length of the screw driven into heat-sink is 2.5mm.

Package Information

Package type

moisture sensitivity level 3, moisture barrier bags.

Minimal package QTY

192 pcs.

Package disassembly

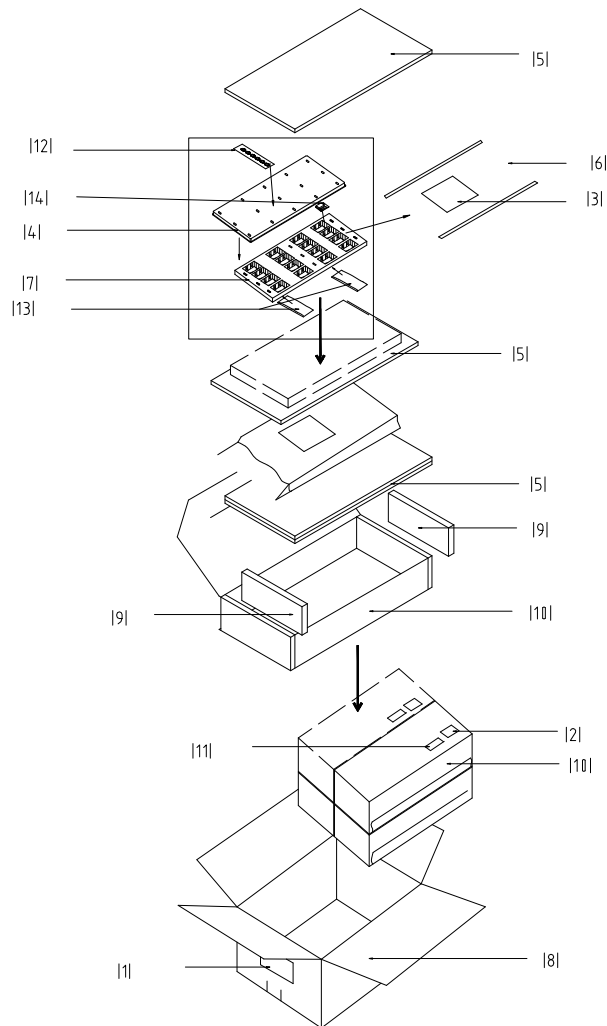
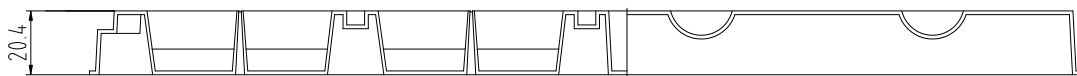


Figure 21 Package disassembly

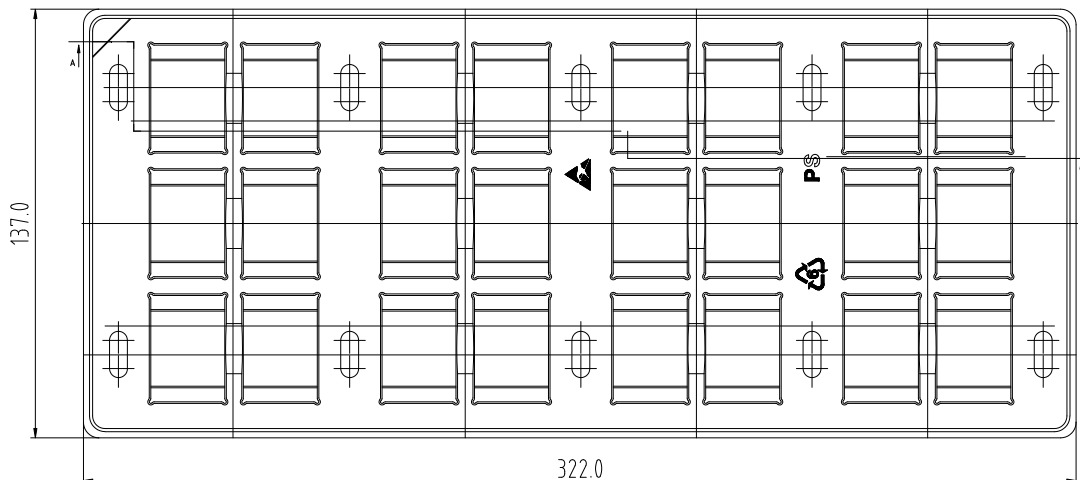
Table 7. Assemblies description

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



SECTION A-A



Record of Revision and Changes

Issue	Date	Description	Originators
1.0	12.04.2014	First Issue	E. Wang
1.1	03.10.2015	Update efficiency specification	E. Wang
1.2	03.13.2015	Update thermal consideration part	E. Wang
1.3	05.18.2015	Add DC current-limit inception	E. Wang
1.4	09.17.2015	Update maximum input current and efficiency curve	E. Wang
1.5	11.10.2015	Update the efficiency and weight	K. Wang
1.6	09.01.2016	Update efficiency curve	E.Wang
1.7	02.24.2020	Update RoHS status	C.Liu
1.8	03.13.2020	Add Pin length in page12	K. Wang

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