TECHNICAL REFERENCE NOTE

ARTESYN AVD200-48S12 SERIES

200 Watts 1/16 Brick Converter

PRODUCT DESCRIPTION

Advanced Energy's Artesyn AVD200-48S12 series is a single output DC/DC converter with standard sixteenth-brick form factor and pin configuration. It delivers up to 17A output current with 12V output. Above 93.9% efficiency and excellent thermal performance makes it an ideal choice to supply power in datacom and telecommunication applications. It can operate over an ambient temperature range of -40°C to +85°C.

AT A GLANCE

Total Power

200 Watts

Input Voltage

36 to 75 Vdc

# of Outputs

Single

RoHS

SPECIAL FEATURES

- Delivering up to 17A output current
- Ultra-high efficiency 93.9% typ. at 60% load
- Wide input range: 36 to 75Vdc
- Excellent thermal performance
- No minimum load requirement
- Basic isolation
- High power density
- Low output noise
- RoHS 3.0
- Remote control
- Trim function: 80% to 110%
- Input under voltage lockout
- Output over current protection
- Output short circuit protection
- Output over voltage protection
- Over temperature protection

SAFETY

- IEC/EN/UL/CSA 62368-1
- UL/TUV
- UL94, V-0
- CE and UKCA Mark
- EN55032 Class A

TYPICAL APPLICATIONS

- Datacom
- Telecommunication

MODEL NUMBERS

Standard	Output Voltage	Structure	Remote ON/OFF logic	Pin	Package
AVD200-48S12B-7TL	12Vdc	Baseplate	Negative	PIP through hole	Tape reel
AVD200-48S12PB-7TL	12Vdc	Baseplate	Positive	PIP through hole	Tape reel
AVD200-48S12TL	12Vdc	Open-frame	Negative	Bullet pin SMT	Tape reel
AVD200-48S12-6L	12Vdc	Open-frame	Negative	Through hole	Tray
AVD200-48S12P-6L	12Vdc	Open-frame	Positive	Through hole	Tray
AVD200-48S12B-6L	12Vdc	Baseplate	Negative	Through hole	Tray
AVD200-48S12PB-6L	12Vdc	Baseplate	Positive	Through hole	Tray

Order Information

AVD200	-	48	S	12	P	B	-	7	T	L
①		②	③	④	⑤	⑥		⑦	⑧	⑨

①	Model series	AVD: Standard sixteenth-brick series, 200: output power 200W
②	Input voltage	48: 36V ~ 75V input range, rated input voltage 48V
③	Output number	S: single output
④	Rated output voltage	12: 12V 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, 7: 1.6mm, Pin Length
⑧	Package	Default : tray, T: tape reel package
⑨	RoHS status	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	All modules	$V_{IN,DC}$	-	-	80	Vdc
Non-operating -100mS	All modules		-	-	100	Vdc
Maximum Output Power	All modules	$P_{O,max}$	-	-	200	W
Isolation Voltage[1]						
Input to Output	All modules		-	-	2250	Vdc
Input to Baseplate	All modules		-	-	1500	Vdc
Output to Baseplate	All modules		-	-	750	Vdc
Insulation Resistance						
Input to Output	All modules		-	-	10	Mohm
Input to Baseplate	All modules		-	-	10	Mohm
Output to Baseplate	All modules		-	-	10	Mohm
Ambient Operating Temperature	All modules	T_A	-40	-	+85	^{O}C
Baseplate Operating Temperature	All modules	T_{BP}	-40	-	100	^{O}C
Storage Temperature	All modules	T_{STG}	-55	-	125	^{O}C
Operating / Storage Altitude	All modules		0	-	4000	meters
Humidity (non-condensing)						
Operating	All modules		10	-	95	%
Storage	All modules		10	-	95	%
MTBF Telcordia, SR332, Method 1, Case 1	All modules		-	8	-	MHrs

Note 1 - 1mA for 60s, slew rate of 1500V/10s. Basic insulation, pollution degree 2.

ELECTRICAL SPECIFICATIONS

Input Specifications

Table 2. Input Specifications

Parameter	Condition[1]	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, DC	All	$V_{IN,DC}$	36	-	75	Vdc
Turn-on Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,ON}$	30	-	35	Vdc
Turn-off Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,OFF}$	28	-	33	Vdc
Lockout Voltage Hysteresis	All		1	-	3	Vdc
Maximum Input Current ($I_O = I_{O,max}$)	$V_{IN,DC}$ = 36-75Vdc	$I_{IN,max}$	-	6	7	A
No Load Input Current (V_O Enable, I_O = 0A)	All	I_{IN,no_load}	-	0.05	0.17	A
Recommended External Input Capacitance	Low ESR capacitor recommended	C_{IN}	100	-	-	uF
Input Reflected Ripple Current[2]	Through 12uH inductor		-	50	-	mA_{PK-PK}
Operating Efficiency	T_A=25 °C, Vin = 48Vdc Airflow rate = 800 LFM $I_O = I_{O,max}$ I_O = 60% $I_{O,max}$	η	92.5 93.0	93.5 93.9	- -	% %

Note 1 - Ta = 25 °C, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise indicated.
Note 2 - Tested with the circuit as Figure18.

ELECTRICAL SPECIFICATIONS

Output Specifications

Table 3. Output Specifications

Parameter		Condition[1]	Symbol	Min	Typ	Max	Unit
Factory Set Voltage		$V_{IN,DC}$= 48VDC I_O = 8.5A	$V_{O,factory}$	11.76	11.90	12.24	Vdc
Output Voltage Line Regulation		All	V_O	-	±10	±60	mV
Output Voltage Load Regulation		All	V_O	-	±10	±60	mV
Output Voltage Temperature Regulation		All	$\%V_O$	-	-	0.02	%/°C
Output Voltage Trim Range[2]		$V_{IN,DC}$ ≥39.5Vdc	V_O	9.6	-	13.2	Vdc
Output Ripple, pk-pk[3]		20MHz bandwidth $I_O = I_{O,max}$	$V_{O,ripple}$	-	128	280	mV_{PK-PK}
Output Current		All	$I_{O,peak}$	0 (0.9)[4]	-	17	A
Dynamic Response	Peak Deviation Settling Time	25% load change, from 50% $I_{O,max,}$ 0.1A/uS	$\pm V_O$ T_s	- -	210 200	500 1000	mV uS
		25% load change from 50% $I_{O,max,}$ 1A/uS	$\pm V_O$ T_s	- -	260 200	600 1000	mV uS
		10%~90%~10% $I_{O,max}$ Load Change, 1A/uS, 400Hz (Duty On - 60%)	$\pm V_O$	-	430	1300	mV
V_O Load Capacitance[5]		All		220	-	5000	uF
Turn-on Transient	Turn-on delay time	All	$T_{turn-on}$	-	-	50	mS
	Rise time	All	T_{rise}	-	-	40	mS
	Output voltage overshoot	All	%Vo	-	-	5	%
Switching Frequency		All	fsw	-	200	-	KHz
Remote ON/OFF Control (Negative Logic Default)	Off-state voltage	All		3.0	-	20	Vdc
	On-state voltage	All		-0.3	-	1.2	Vdc
Remote ON/OFF Control (Positive Logic Default)	Off-state voltage	All		-0.3	-	1.2	Vdc
	On-state voltage	All		3.0	-	20	Vdc
Output Over-voltage Protection[6]		All	V_O	13.7	-	19	Vdc
Output Over-temperature Protection[7]		Open frame	T	110	-	135	°C
		Baseplate	T	100	-	125	°C
Over-temperature Hysteresis		Open frame	T	5	-	-	°C
Output Voltage Remove Sense Range		All		-	-	0.5	V

Note 1 - Ta = 25 °C, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise noted.
Note 2 - The max output power is 200W when trimming up. When trimming up, the output current should be decreased accordingly so as not to exceed the maximum output power. When Vin ≥ 39.5V, Vo can trim up to 13.2V.
Note 3 - Measure with the circuit as Figure18. During the ripple test, the ceramic capacitor should be as close as possible to the coaxial cable.
Note 4 - A load of min 0.9 A is needed to enable synchronous rectified mode after start-up. The load can be relaxed to 0 A once the converter has entered synchronous rectified mode.
Note 5 - High requency and low ESR is recommended.
Note 6 - Hiccup, auto-restart when over-voltage condition is removed.
Note 7 - Baseplate test point is the middle of the baseplate. Open frame test point is on RT (Resistance Thermometer). Please refer to page 16 for details.

ELECTRICAL SPECIFICATIONS

AVD200-48S12-6L Performance Curves

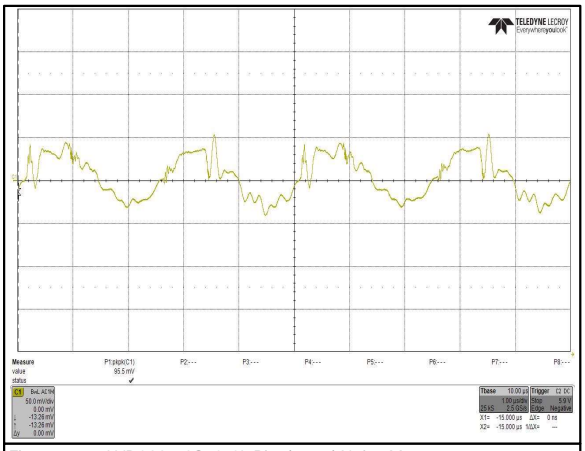


Figure 1: AVD200-48S12-6L Ripple and Noise Measurement
Vin = 48Vdc Load: Io = 17A
Ch 1: Vo (1uS/div, 50mV/div)

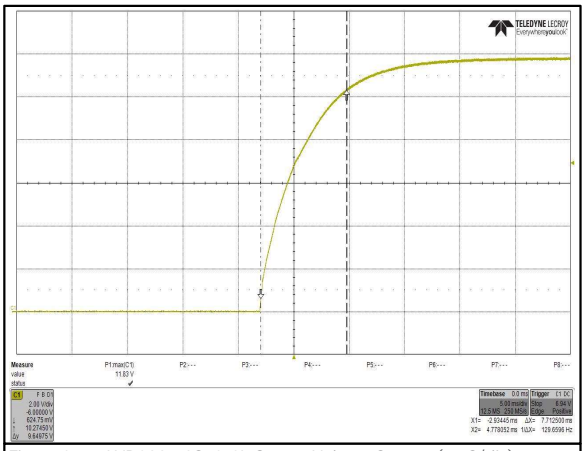


Figure 2: AVD200-48S12-6L Output Voltage Startup (5mS/div)
Vin = 48Vdc Load: Io = 17A
Ch 1: Vo (2V/div)

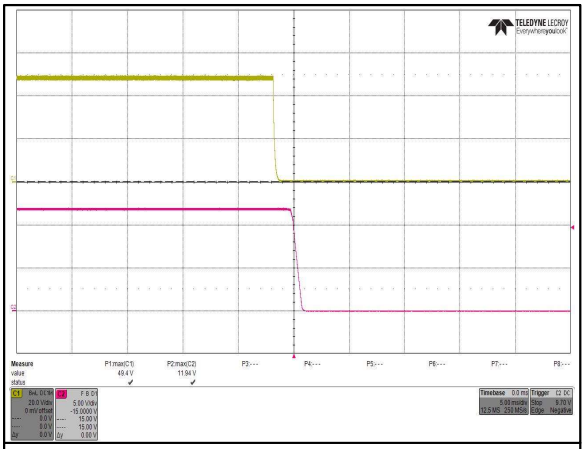


Figure 3: AVD200-48S12-6L Turn Off Characteristic (5mS/div)
Vin = 48Vdc Load: Io = 17A
Ch 1: Vin (20V/div) Ch 2: Vo (5V/div)

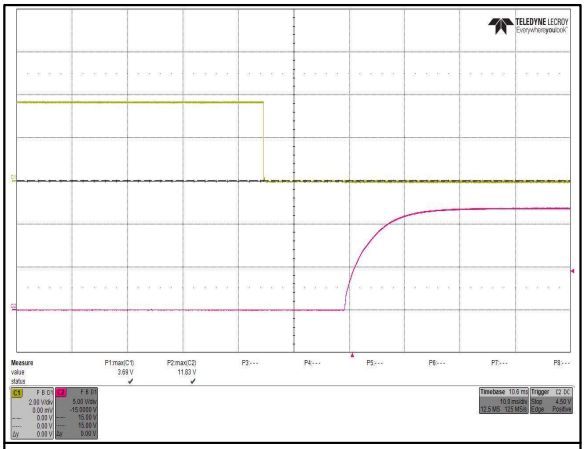


Figure 4: AVD200-48S12-6L Remote ON Waveform (10mS/div)
Vin = 48Vdc Load: Io = 17A
Ch 1: Remote ON (2V/div) Ch 2: Vo (5V/div)

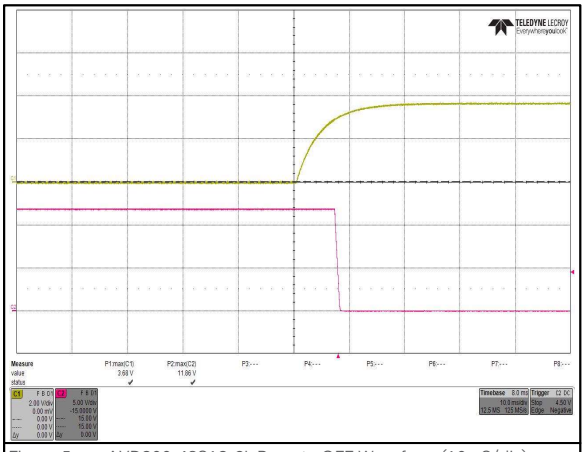


Figure 5: AVD200-48S12-6L Remote OFF Waveform (10mS/div)
Vin = 48Vdc Load: Io = 17A
Ch 1: Remote ON (2V/div) Ch 2: Vo (5V/div)

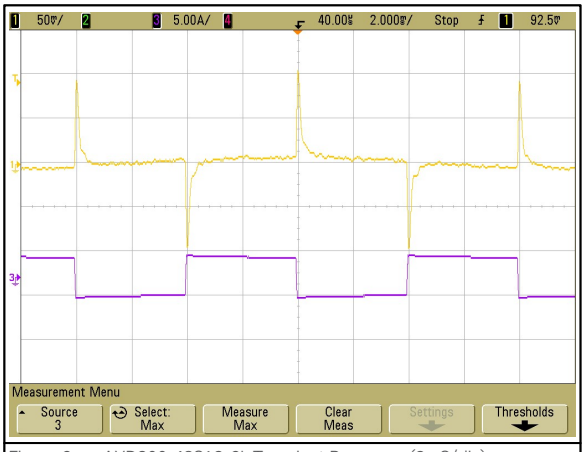


Figure 6: AVD200-48S12-6L Transient Response (2mS/div)
Vin = 48Vdc Io = 50%~75%~50% load change, 0.1A/uS,
Ch 1: Vo (50mV/div) Ch 3: Io (5A/div)

ELECTRICAL SPECIFICATIONS

AVD200-48S12 Performance Curves

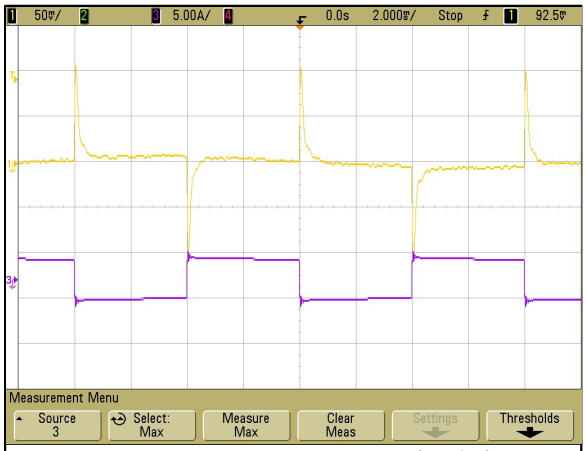


Figure 7: AVD200-48S12-6L Transient Response (2mS/div)
Vin = 48Vdc Io = 25% to 50% load change, 1A/Us
Ch 1: Vo (50mV/div) Ch 3: Io (5A/div)

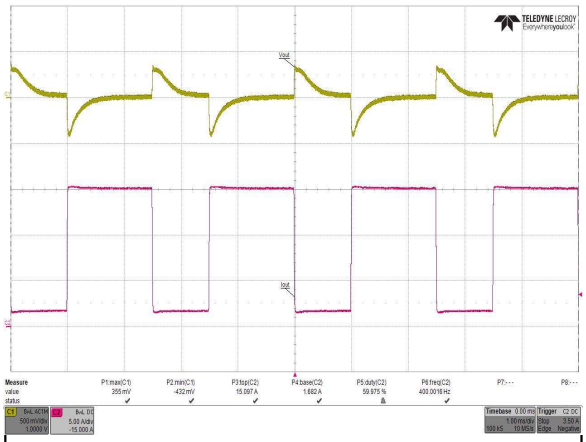


Figure 8: AVD200-48S12-6L Transient Response (1mS/div)
Vin = 48Vdc Io = 10% to 90% to 10% load change, 1A/Us
Ch 1: Vo (500mV/div) Ch 3: Io (5A/div)

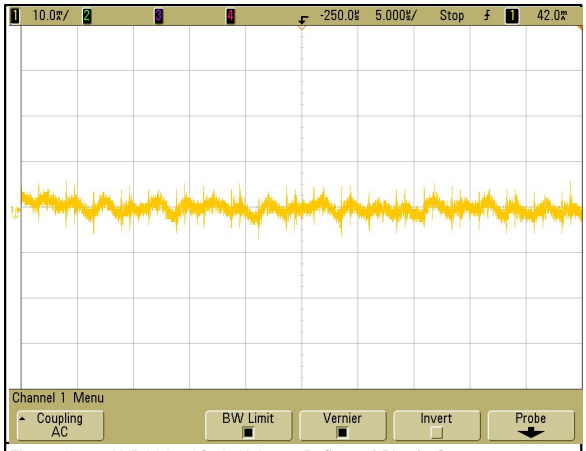


Figure 9: AVD200-48S12-6L Input Reflected Ripple Current
Vin = 48Vdc Load: Io = 17A
Ch 1: Iin (5uS/div, 50mV/div)

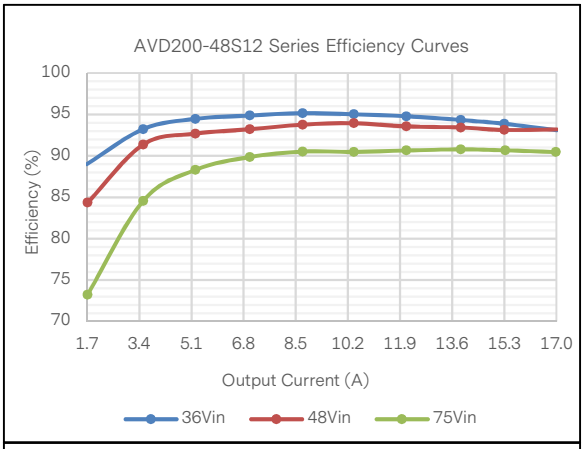


Figure 10: AVD200-48S12-6L Efficiency Curves @ 25 °C, 800LFM

Vin = 36-75Vdc Loading: Io = 10% increment to 17A

ELECTRICAL SPECIFICATIONS

Protection Function Specifications

Over Voltage Protection (OVP)

The AVD200-48S12 series output will hiccup during output overvoltage. The maximum over voltage point is 19Vdc. Recovery is automatic when overvoltage is removed.

Parameter	Model	Min	Typ	Max	Unit
V_O Output Overvoltage	All	13.7	-	19.0	Vdc

Over Current Protection (OCP)

The AVD200-48S12 series includes internal current limit circuitry to prevent damage in the event of overload or short circuit. The OCP mode is hiccup. Recovery is automatic when the overload is removed.

Parameter	Model	Min	Typ	Max	Unit
V_O Output Overcurrent	All	19	-	33	A

Short Circuit Protection (SCP)

The AVD200-48S12 series can withstand a continuous short circuit with no permanent damage. The converter will automatically restart when the short circuit is removed. The SCP mode is hiccup. Short current is 29Arms maximum (Vo ≤ 5% V_{ONOM}).

Over Temperature Protection (OTP)

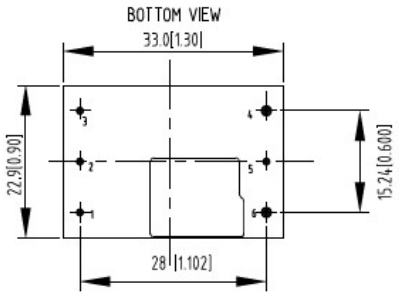
The AVD200-48S12 series will shut down during over-temperature condition and return back to normal operation when the converter is cooled down (including hysteresis). The AVD200-48S12 series converter might experience over-temperature conditions during a persistent overload on the output. Overload conditions can be caused by external faults. OTP might also be entered due to a loss of control of the environmental conditions e.g. an increase in the converter's ambient temperature due to a failing fan or external cooling system etc.

Parameter	Model	Note	Min	Typ	Max	Unit
V_O Output Over Temperature	Baseplate	The middle of baseplate	100	-	125	°C
	Open-frame	Test point see page 16	110	-	135	°C
	Open-frame	Hysteresis	5	-	-	°C

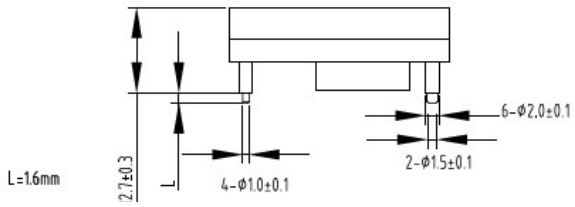
MECHANICAL SPECIFICATIONS

Mechanical Outlines (unit: mm)

AVD200-48S12B-7TL

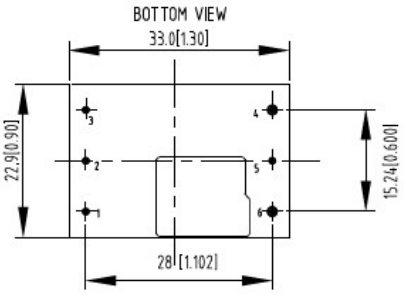


SIDE VIEW

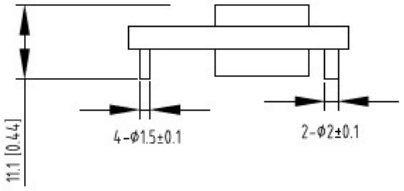


AVD200-48S12-6L

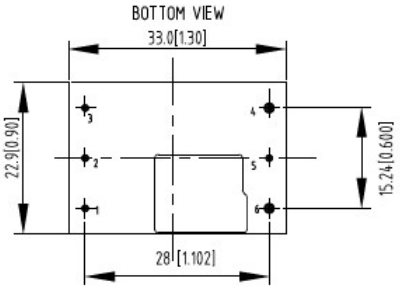
AVD200-48S12TL



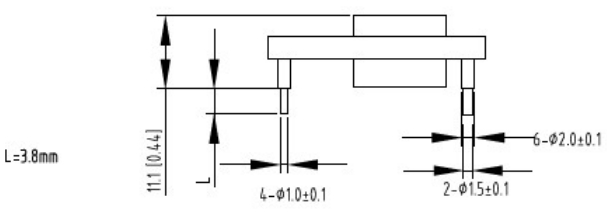
SIDE VIEW

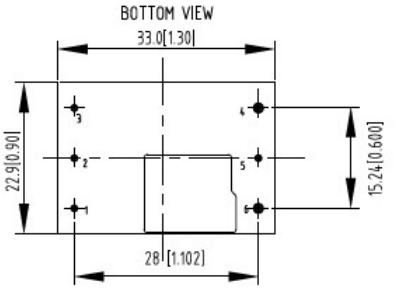


AVD200-48S12B-6L

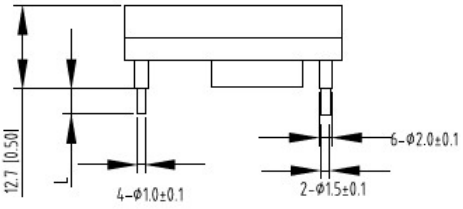


SIDE VIEW





SIDE VIEW



UNIT: mm (inch)
L: 1.60mm±0.25mm for AVD200-48S12(PB)-7TL; 3.80mm±0.25mm for AVD200-48S12(PB)-6L.
TOLERANCE: X.X mm±0.5mm [X.XX in.± 0.02in.]
X.XX mm±0.25mm[X.XXX in.±0.01in.]

MECHANICAL SPECIFICATIONS

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	Trim	Output voltage trim
6	Vo+	Positive output voltage

Pin Size

Device code suffix	Pin size
-4	4.8mm±0.25mm
-6	3.8mm±0.25mm
-8	2.8mm±0.25mm
-7	1.6mm±0.25mm

MECHANICAL SPECIFICATIONS

Weight

25g typical, 28.5g maximum, 21.5g minimum for baseplate module.

18g typical, 21g maximum, 15g minimum for open-frame module.

Environmental Specifications

EMC Immunity

AVD200-48S12 series power supply is designed to meet the following EMC immunity specifications.

Table 4. Environmental Specifications

Document	Description	Criteria
EN55032 DC Input Port, Class A Limits	Conducted Emission	/
IEC/EN 61000-4-2 Enclosure Port, Level 3	Immunity to Electrostatic Discharge	B
IEC/EN 61000-4-4 DC Input Port, Level 3	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
IEC/EN 61000-4-6, DC Input Port, Level 2	Immunity to Continuous Conducted Interference	A
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: 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 of hardware.

ENVIRONMENTAL SPECIFICATIONS

EMC Test Conditions

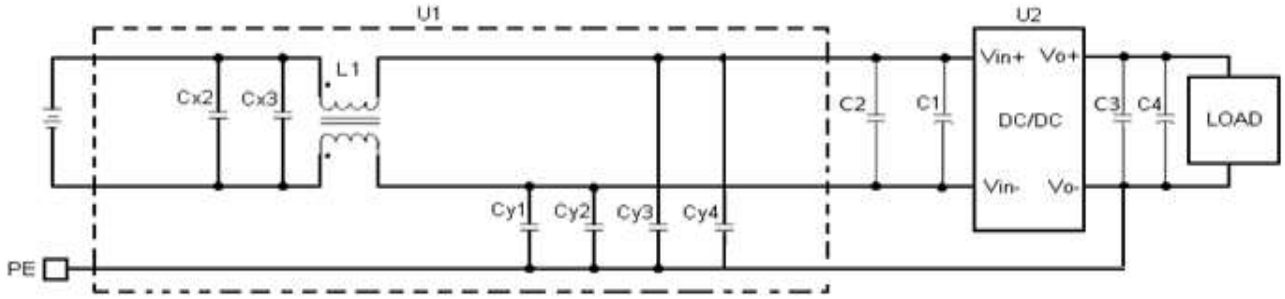


Figure 11 EMC test configuration

C1: 220µF/100V electrolytic capacitor; P/N: UPM2A221MPD (Nichicon) or equivalent caps.

C2: 0.1µF/100V X7R ceramic capacitor.

C3: 22µF/25V X7R ceramic capacitor.

C4: 470µF electrolytic capacitor, P/N: OSCON or POSCAP.

U1: Input EMC filter.

U2: Module to test, AVD200-48S12.

CX2, CX3: 2.2µF/100V/X7R capacitor.

Cy1, Cy2, Cy3, Cy4: 0.22µF/630V/X7R, Y capacitor.

L2: 809µH, common mode inductor.

Fuse: External fast blow fuse with a rating of 15A. The recommended fuse model is 0314015.P from Littelfuse.

ENVIRONMENTAL SPECIFICATIONS

Safety Certifications

The AVD200-48S12 series module 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 AVD200-48S12 series module

Standard	Agency	Description
UL 62368-1, 2nd Ed, 2014-12-01, CAN/CSA C22.2 No. 62368-1-14, 2nd Ed	UL+CUL	US and Canada Requirements
EN 62368-1:2014/A11:2017	TUV	Europe Requirements
EN 62368-1:2014/A11:2017	CE	CE marking by internal verification /certificate
UKCA Mark		UK Requirements

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature

The AVD200-48S12 series module 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 - Base plate module

The converter is designed to operate in different thermal environments and sufficient cooling must be provided. For a typical application, There is the thermal derating data of output current vs. ambient air temperature at different air velocity @48Vin for baseplate module in Figure 12b. The temperature at these test points recommend not exceed the values in Table 6.

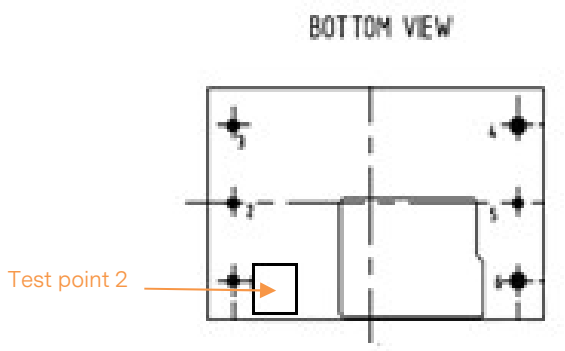


Figure 12a Temperature test point

Table 6. Recommend temperature limit of the test point	
Test Point	**Temperature Limit (°C)**
Test point 1 (The middle of baseplate)	101
Test point 2	112

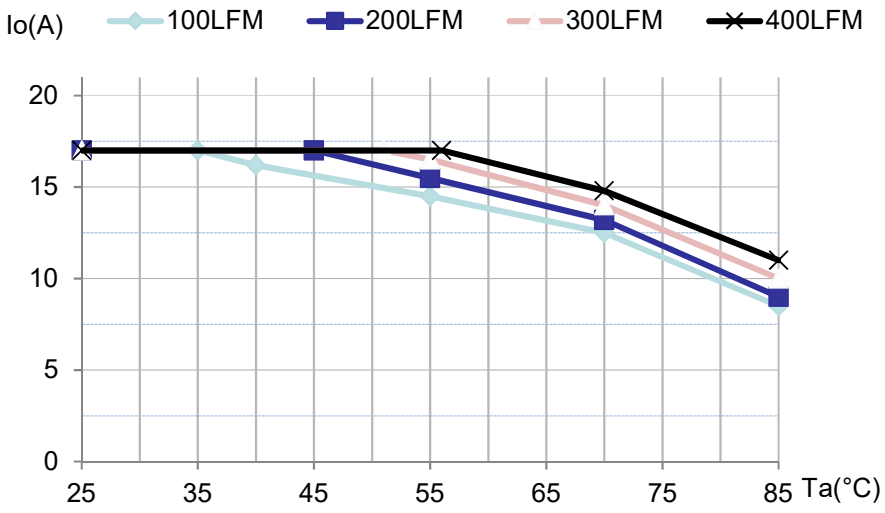


Figure 12b Thermal derating data for baseplate module @48Vin without heatsink, airflow from Vin- to Vin+

ENVIRONMENTAL SPECIFICATIONS

Thermal Considerations - Open-frame module

The AVD200-48S12 converter is designed to operate in different thermal environments and sufficient cooling must be provided. For a typical application, There is the thermal derating data of output current vs. ambient air temperature at different air velocity @48Vin for open frame module in Figure 14. The temperature at these test points recommend not exceed the values in Table 7.

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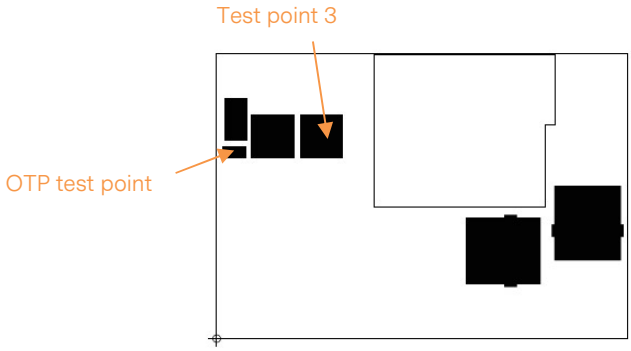


Figure 13 Temperature test point (Top View)

Table 7. Recommend temperature limit of the test point	
Test Point	**Temperature Limit (°C)**
OTP test point (Open frame, RT)	109
Test point 3	121

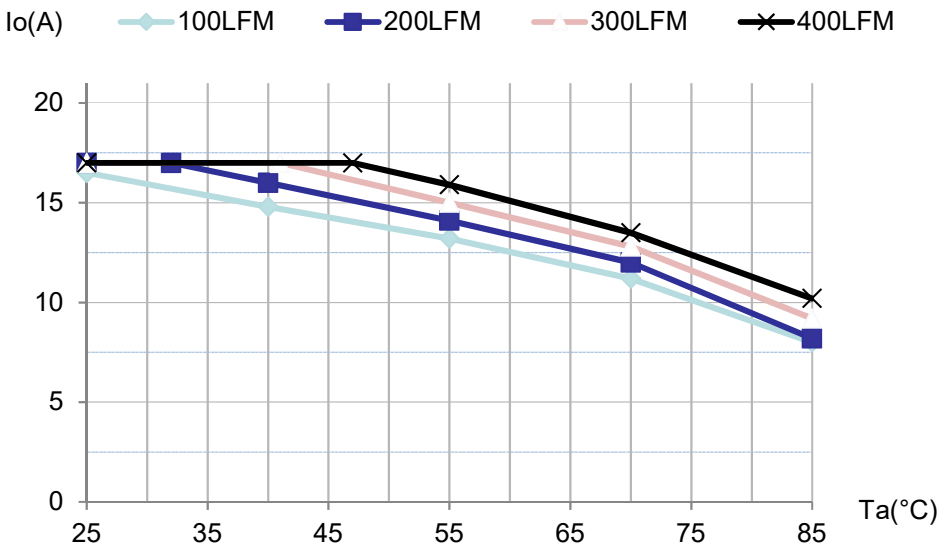


Figure 14 Thermal derating data for open frame module @48Vin, airflow from Vin- to Vin+

ENVIRONMENTAL SPECIFICATIONS

Qualification Testing

Parameter	Unit (pcs)	Test condition
HALT test	2	Ta,min -20 ^{O}C to Ta,max +25 ^{O}C, 10 ^{O}C step, Vin = min to max, 0 ~ 100% load Vibration Limit: >30G.
Vibration	2	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. Non operational
Mechanical Shock	2	Half sine, Acceleration: 30g, 6 ms, 6directions, 3times/face. Non operational
Thermal Shock	3	-55 ^{O}C to 125 ^{O}C, Temp Dwell Time:30min, Temp change rate: 20 ^{O}C/min, unit temperature 20cycles
Thermal Cycling	3	-40 ^{O}C to 85 ^{O}C, temperature change rate: 1^{O}C/min, 2cycles
Humidity	3	40 ^{O}C, 95%RH, 48hours

APPLICATION NOTES

Typical Application

Below is the typical application of the AVD200-48S12 series power supply.

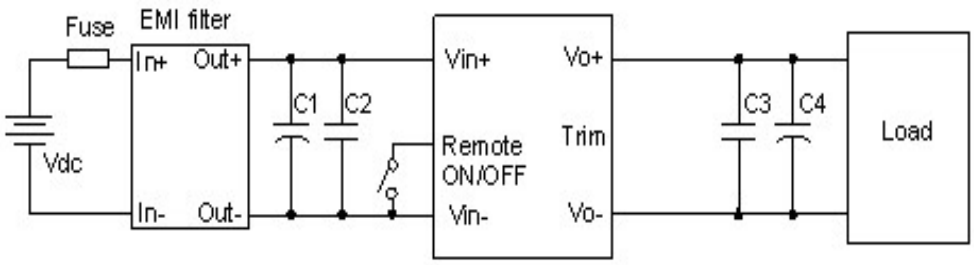


Figure 15 Typical application

C1: 220uF/100V electrolytic capacitor; P/N: UPM2A221MPD (Nichicon) or equivalent capacitors.

C2: 4.7uF/100V X7R ceramic capacitor.

C3: 22uF/25V X7R ceramic capacitor.

C4: 1470uF electrolytic capacitor, low ESR capacitor.

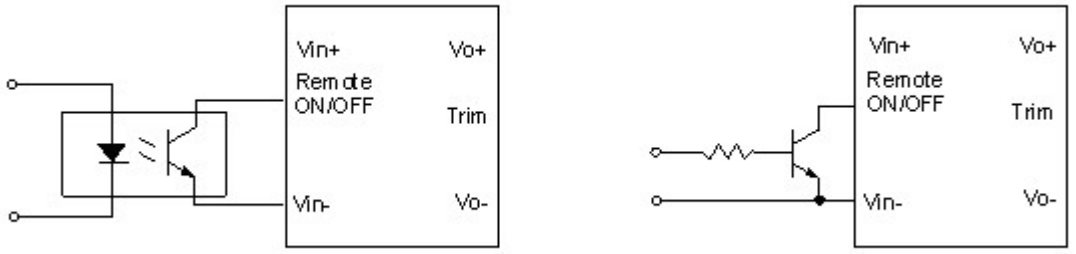
Fuse: External fast blow fuse with a rating of 15A. The recommended fuse model is 0314015.P from Littelfuse.

APPLICATION NOTES

Remote ON/OFF

Negative remote ON/OFF logic is available in AVD200-48S12 series. 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 16.



Isolated remote ON/OFF circuit

Non-isolated remote ON/OFF circuit

Figure 16 External Remote ON/OFF circuit

APPLICATION NOTES

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.

$$R_{adj-down} = \frac{511}{\Delta} - 10.22(K\Omega)$$

$$R_{adj-up} = \frac{5.11 \times V_{nom} \times (100 + \Delta)}{1.225 \times \Delta} - \frac{511}{\Delta} - 10.22(K\Omega)$$

△:Output rate against nominal output voltage.

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

V_{nom}: Nominal output voltage.

For example, to get 13.2V output, the trimming resistor is

$$\Delta = \frac{100 \times |V_{nom} - V_0|}{V_{nom}} = \frac{100 \times (13.2 - 12)}{12} = 10$$

$$R_{adj-up} = \frac{5.11 \times 12 \times (100 + 10)}{1.225 \times 10} - \frac{511}{10} - 10.22 = 489.3(K\Omega)$$

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

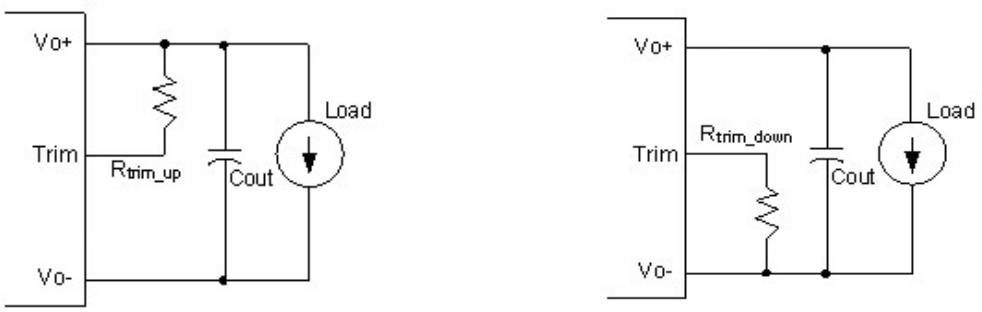


Figure 17 Trim up and trim down

APPLICATION NOTES

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

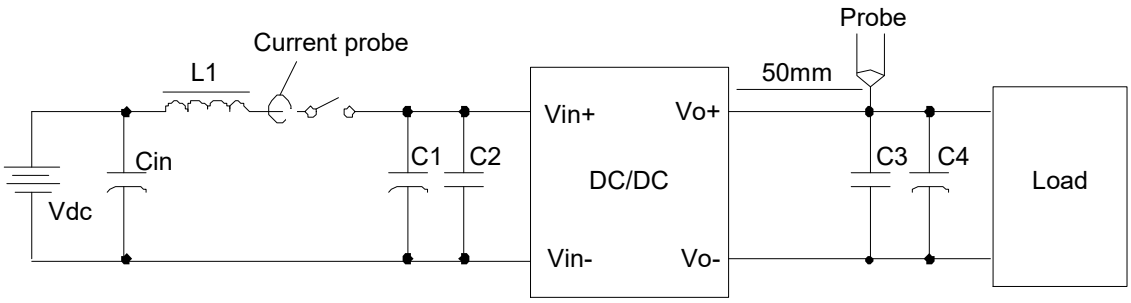


Figure 18 Input ripple & output ripple & noise test configuration

Vdc: DC power supply.

L1: 12uH.

Cin: 220uF/100V typical.

C1: 220uF/100V electrolytic capacitor; P/N: UPM2A221MPD (Nichicon) or equivalent capacitors.

C2: 4.7uF/100V X7R ceramic capacitor.

C3: 22uF/25V X7R ceramic capacitor.

C4: 1470uF electrolytic capacitor, low ESR capacitor.

Note - resistor and ceramic capacitor: 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.

APPLICATION NOTES

Soldering

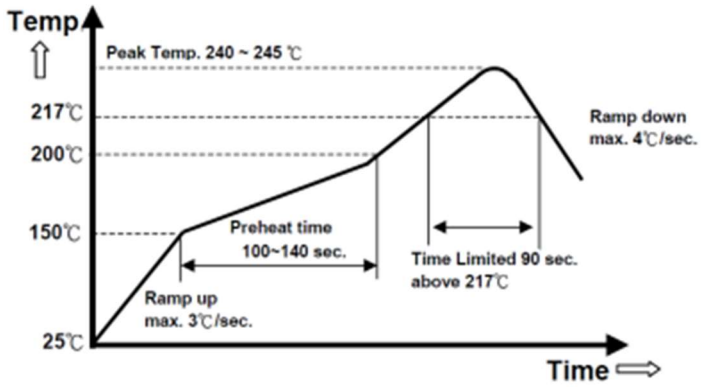
The AVD200-48S12 series is intended for standard manual, wave soldering or reflow soldering.

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.

When wave soldering is used, the temperature on pins is specified to maximum 255 ^{O}C for maximum 7s.

When reflow soldering is used, please refer to following figure for recommended temperature profile parameters.

High temperature and long soldering time will result in IMC layer increasing in thickness and thereby shorten the solder joint lifetime. The soldering time of temperature above 217 ^{O}C should be less than 90 seconds.



Note: The temperature is measured on the pins of power module at the solder joint.

APPLICATION NOTES

Package Information

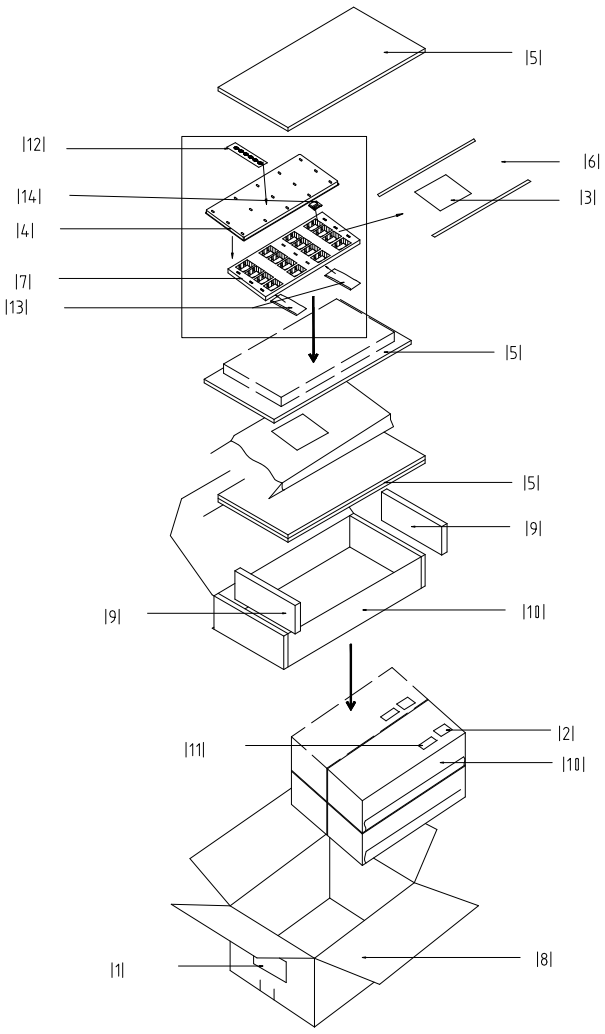
Package type

Moisture sensitivity level 3, moisture barrier bags.

Minimal package QTY

192 pcs.

Package disassembly

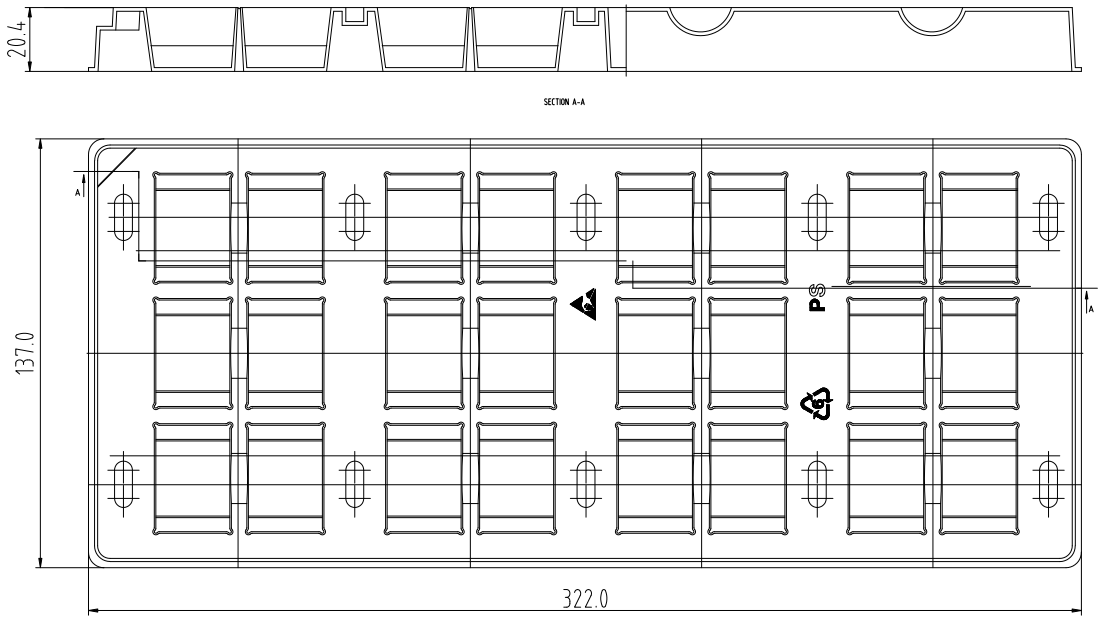


APPLICATION NOTES

Table 6. 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	01.27.2021	First issue	E. Wang
1.1	02.08.2021	Update derating curve and add remote sense spec Update thermal section	K. Wang
1.2	03.10.2021	Update thermal performance, EMC circuit, and soldering description	E. Wang
1.3	04.08.2021	Update Product photo	K. Wang
1.4	05.23.2022	Update UKCA Mark	J. Zhang

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Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

Our products enable customer innovation in complex applications for a wide range of industries including semiconductor equipment, industrial, manufacturing, telecommunications, data center computing, and medical. With deep applications know-how and responsive service and support across the globe, we build collaborative partnerships to meet rapid technological developments, propel growth for our customers, and innovate the future of power.

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For international contact information,
visit advancedenergy.com.

powersales@aei.com (Sales Support)
productsupport.ep@aei.com (Technical Support)
+1 888 412 7832

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