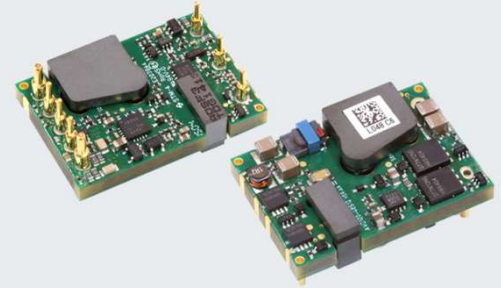


ARTESYN

AVD100-48S05 Series

100 Watts Sixteenth-brick Converter



PRODUCT DESCRIPTION

Advanced Energy's Artesyn 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.

AT A GLANCE

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 3.0

SAFETY

- UL+CUL EN 60950-1
- TUV EN 62368-1
- CE EN 62368-1

TYPICAL APPLICATIONS

- Telecom
- Datacom



MODEL NUMBERS

| Standard | Output Voltage | Structure | Remote ON/OFF logic | ROHS |
|------------------|----------------|------------|---------------------|----------|
| AVD100-48S05TL | 5Vdc | Open-frame | Negative | RoHS 3.0 |
| AVD100-48S05-6L | 5Vdc | Open-frame | Negative | RoHS 3.0 |
| AVD100-48S05B-6L | 5Vdc | Baseplate | Negative | RoHS 3.0 |

Order Information

| | | | | | | | | | |
|--------|---|----|---|----|---|---|---|---|---|
| AVD100 | - | 48 | S | 05 | | 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 | 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.

ELECTRICAL SPECIFICATIONS

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 ($I_O = I_{O,max}$) | $V_{IN,DC} = 36Vdc$ | $I_{IN,max}$ | - | - | 4 | A |
| No Load Input Current (V_O On, $I_O = 0A$, $I_{VSB} = 0A$) | $V_{IN,DC} = 36Vdc$ | I_{IN,no_load} | - | 0.04 | - | A |
| Standby Input Current | $V_{IN,DC} = 36Vdc$ | $I_{IN,standby}$ | - | 0.01 | - | A |
| Recommended Input Fuse | Fast blow external fuse recommended | | - | - | 5 | A |
| Recommended External Input Capacitance | Low ESR capacitor recommended | C_{IN} | - | 100 | - | μF |
| Input Reflected Ripple Current | Through 12 μH inductor | | | 40 | - | mA |
| Input filter component values (C\L) | Internal values | | - | 0\1.2 | - | $\mu F/\mu H$ |
| Operating Efficiency | $T_A = 25\text{ }^\circ C$ $I_O = I_{O,max}$ $I_O = 60\% I_{O,max}$ | η | - | 92.5 93.5 | - | % % |

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

ELECTRICAL SPECIFICATIONS

Output Specifications

| Table 3. Output Specifications | | | | | | | |
|--|---|---|---------------|------|-------|---------------------|------|
| Parameter | Conditions ¹ | Symbol | Min | Typ | Max | Unit | |
| Factory Set Voltage | $V_{IN,DC} = 48Vdc$ $I_O = 50\% I_{O,max}$ | 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 | %/°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 | uF | |
| 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 | uSec |
| Output DC Current-limit Inception ³ | | | 22 | - | 34 | A | |
| Turn-on Transient | Rise time | $I_O = I_{O,max}$ | T_{rise} | - | - | 50 | mS |
| | Turn-on delay time | $I_O = I_{O,max}$ | $T_{turn-on}$ | - | 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, $V_{in} = 48Vdc$, 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

ELECTRICAL SPECIFICATIONS

Output Specifications

| Table 3. Output Specifications Con't | | | | | | |
|---|---|-----------------|-----|-----|-----|-------------------|
| Parameter | Conditions | Symbol | Min | Typ | Max | Unit |
| Output over-voltage protection ⁴ | All | %V _O | 116 | - | 150 | % |
| Output over-temperature protection ⁵ | 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 4 - Hiccup: auto-restart when over-voltage condition is removed.

Note 5 - Auto recovery.

ELECTRICAL SPECIFICATIONS

AVD100-48S05 Performance Curves

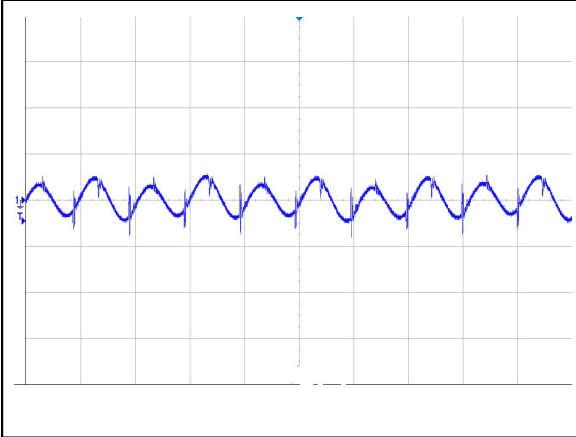


Figure 1: AVD100-48S05 Input Reflected Ripple Current Waveform
Ch 1: Iin (2uS/div, 50mA/div)

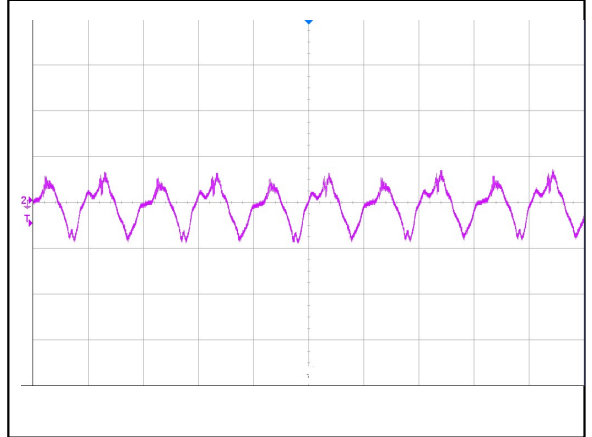


Figure 2: AVD100-48S05 Ripple and Noise Measurement
Ch 2: Vo (2uS/div, 20mV/div)

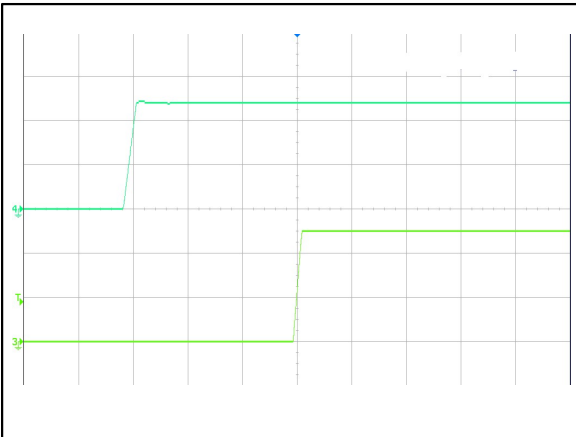


Figure 3: AVD100-48S05 Output Voltage Startup Characteristic (20mS/div)
Ch 4: Vin (20V/div) Ch 3: Vo (2V/div)

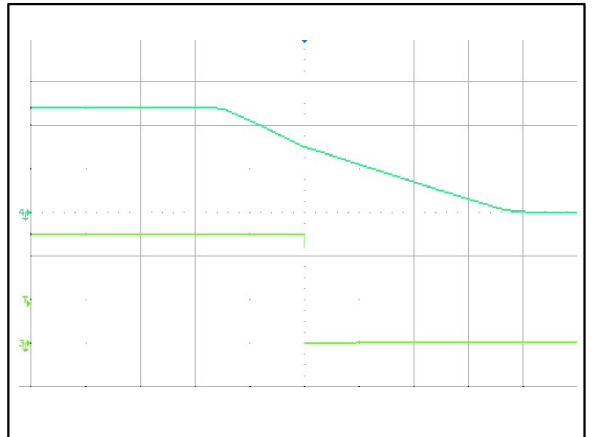


Figure 4: AVD100-48S05 Turn Off Characteristic (20mS/div)
Ch4: Vin (20V/div) Ch 3: Vo (2V/div)

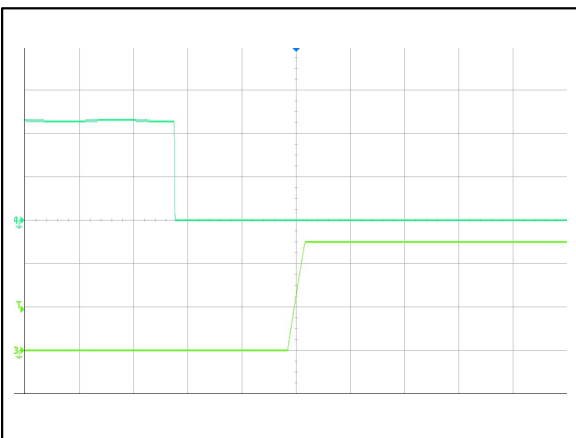


Figure 5: AVD100-48S05 Remote ON Waveform (10mS/div)
Ch 4: Remote ON (2V/div) Ch 3: Vo (2V/div)

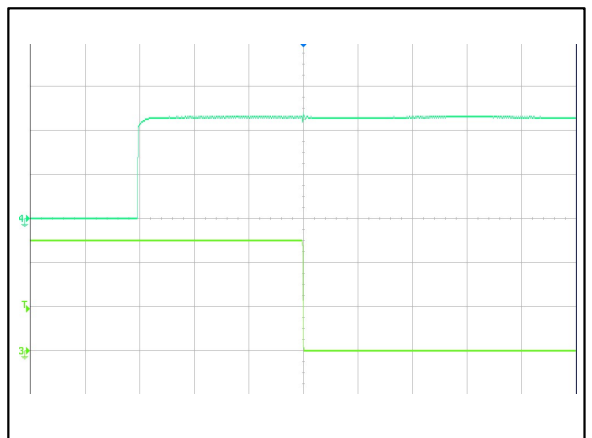


Figure 6: AVD100-48S05 Remote OFF Waveform (5mS/div)
Ch 4: Remote OFF (2V/div) CH3: Vo (2V/div)

ELECTRICAL SPECIFICATIONS

AVD100-48S05 Performance Curves

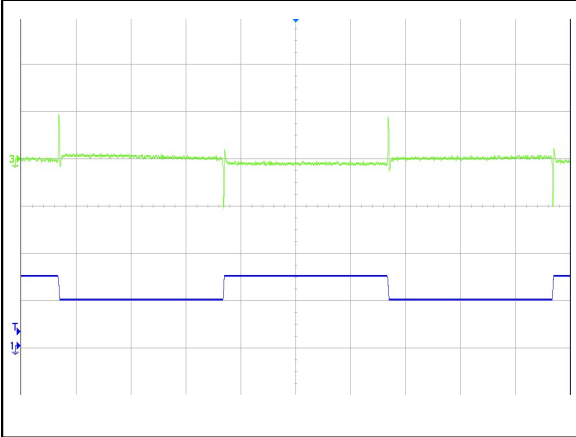


Figure 7: AVD100-48S05 Transient Response (1mS/div)
 50%~75%~50% load change, 0.1A/uS slew rate
 Ch 1: Io (5A/div) Ch 3: Vo (20mV/div)

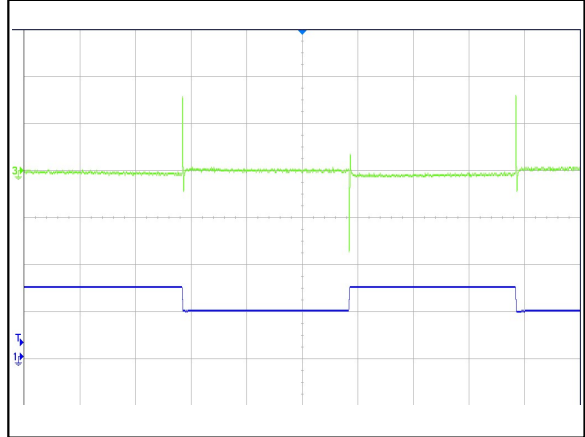


Figure 8: AVD100-48S05 Transient Response (1mS/div)
 50%~75%~50% load change, 1A/uS slew rate
 Ch 1: Io (5A/div) Ch 3: Vo (20mV/div)

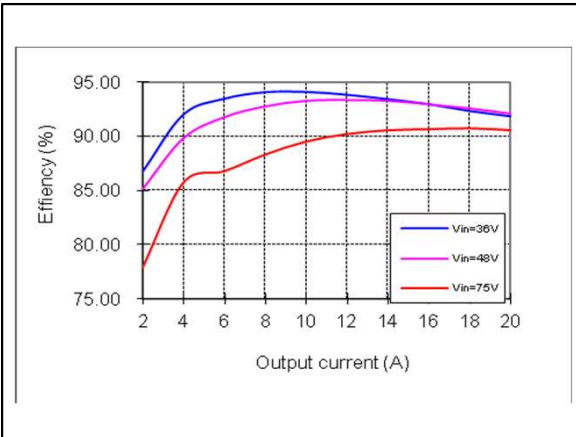


Figure 9: AVD100-48S05 Efficiency Curves @ 25 °C, 200LFM, Vo=5V
 Loading: Io = 10% increment to 20A

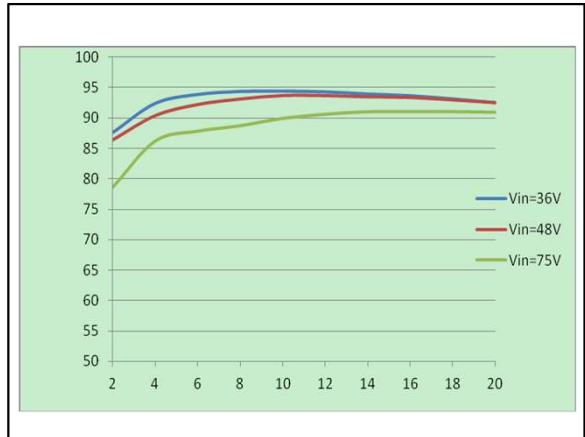
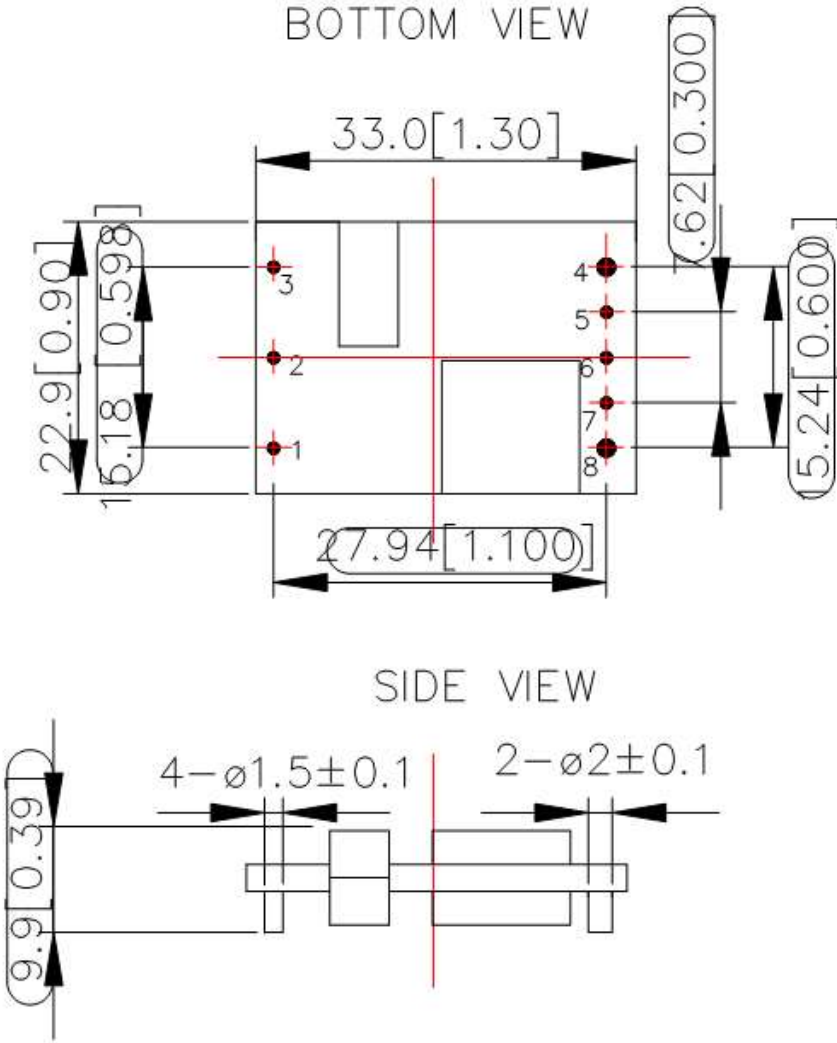


Figure 10: AVD100-48S05B Efficiency Curves @ 25 °C, 200LFM, Vo=5V
 Loading: Io = 10% increment to 20A

MECHANICAL SPECIFICATIONS

Mechanical Outlines – Surface Mounted Module

AVD100-48S05TL

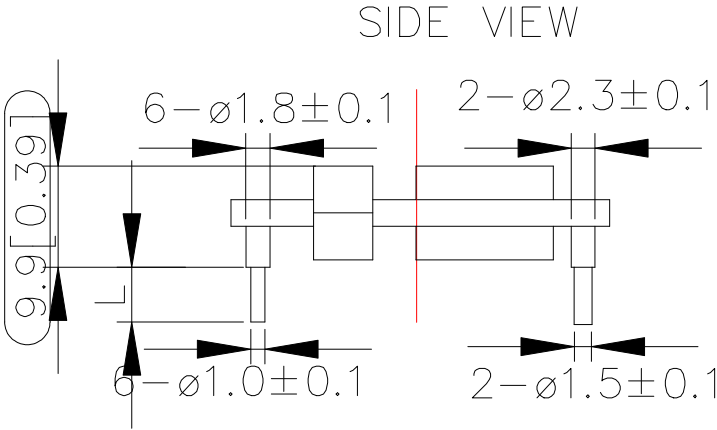
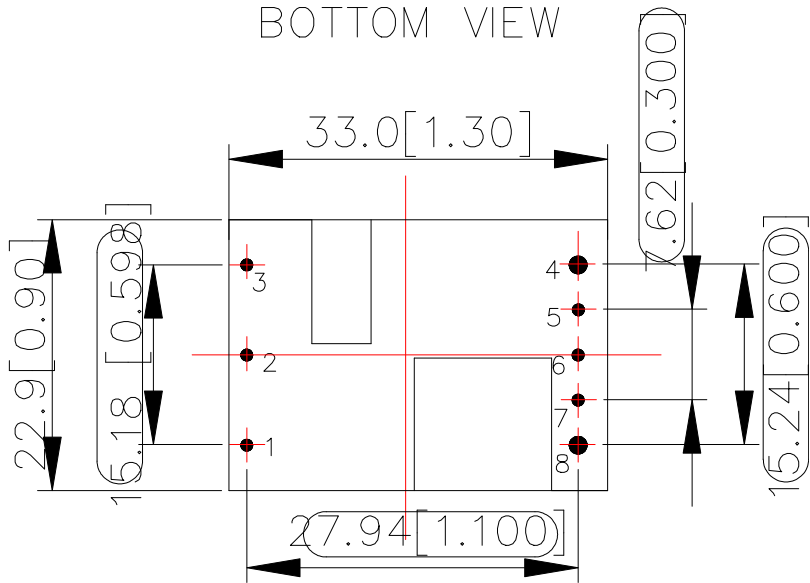


UNIT: mm [inch]
TOLERANCE: X.Xmm±0.5mm[X.XX in.±0.02in.]
X.XXmm±0.25mm[X.XXX in.±0.01in.]

MECHANICAL SPECIFICATIONS

Mechanical Outlines – Open Frame Module

AVD100-48S05-6L



UNIT: mm [inch] = 3.80 ± 0.25mm

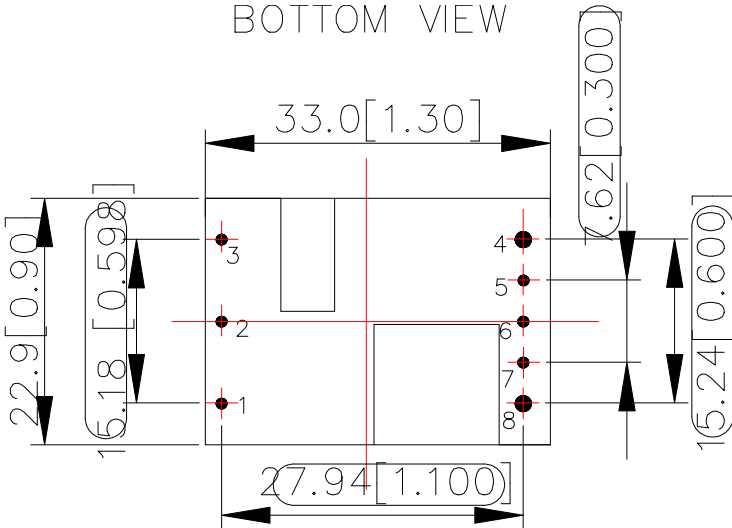
TOLERANCE: X.Xmm ± 0.5mm [X.XX in. ± 0.02in.]

X.XXmm ± 0.25mm [X.XXX in. ± 0.01in.]

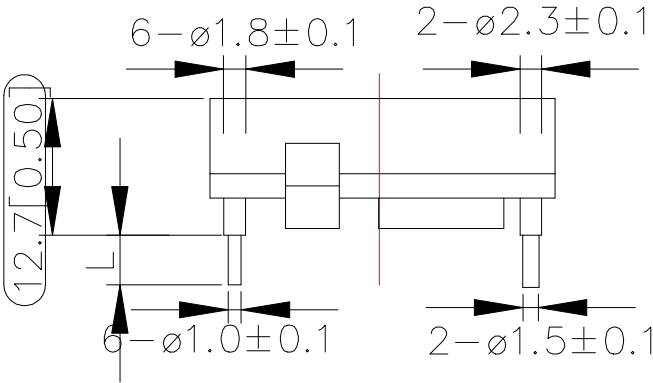
MECHANICAL SPECIFICATIONS

Mechanical Outlines – Baseplate Module

AVD100-48S05B-6L



SIDE VIEW



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.]

Note: Depth penetration into base plate, of M3 screws used at baseplate mounting holes, not to exceed maximum of 3.0mm

MECHANICAL SPECIFICATIONS

Pin length option

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

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

Electromagnetic compatibility Characteristics

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

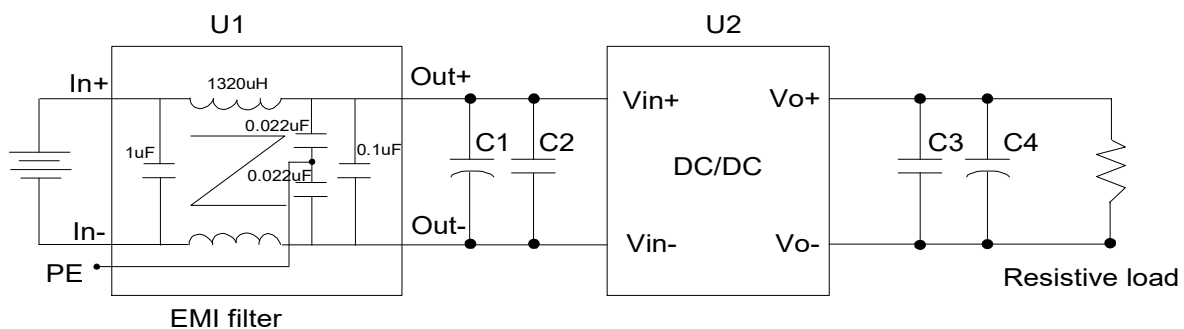


Figure 11 EMC test configuration

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

ENVIRONMENTAL SPECIFICATIONS

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 | | |
|---|---------|----------------------------|
| Standard | Agency | Description |
| UL 60950-1, 2nd Edition, 2014-10-14; CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10 | UL+CUL | US and Canada Requirements |
| EN 62368-1:2014/A11:2017 | TUV-SUD | European Requirements |
| EN 62368-1:2014/A11:2017 | CE | CE Marking |

ENVIRONMENTAL SPECIFICATIONS

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.

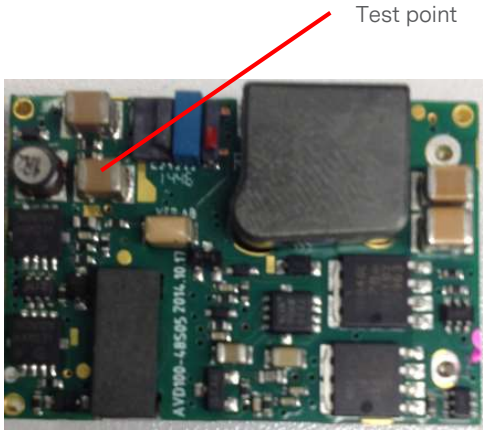


Figure 12 Temperature test point

| Table 6. Temperature limit of the test point | |
|--|-------------------|
| Test Point | Temperature limit |
| Test Point | 115 °C |

ENVIRONMENTAL SPECIFICATIONS

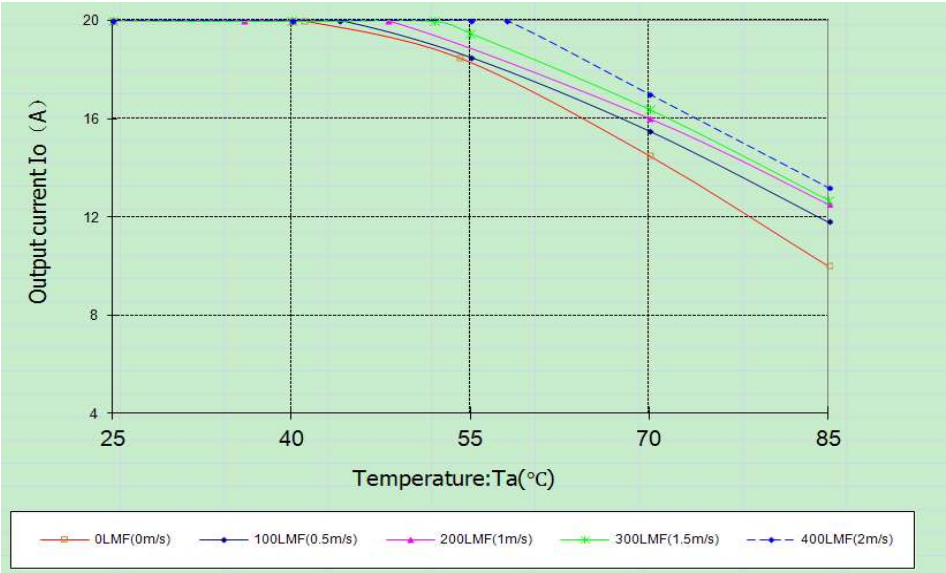


Figure 13 Derating curve

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.

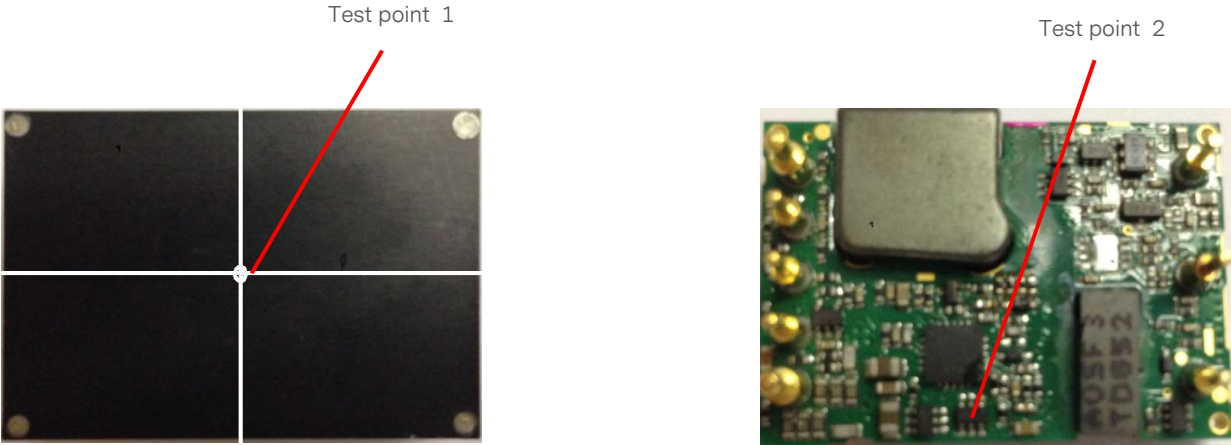


Figure 14 Temperature test point

ENVIRONMENTAL SPECIFICATIONS

| Table 7. Temperature limit of the test point | |
|--|-------------------|
| Test Point | Temperature limit |
| Test point 1 | 108 °C |
| Test point 2 | 113 °C |

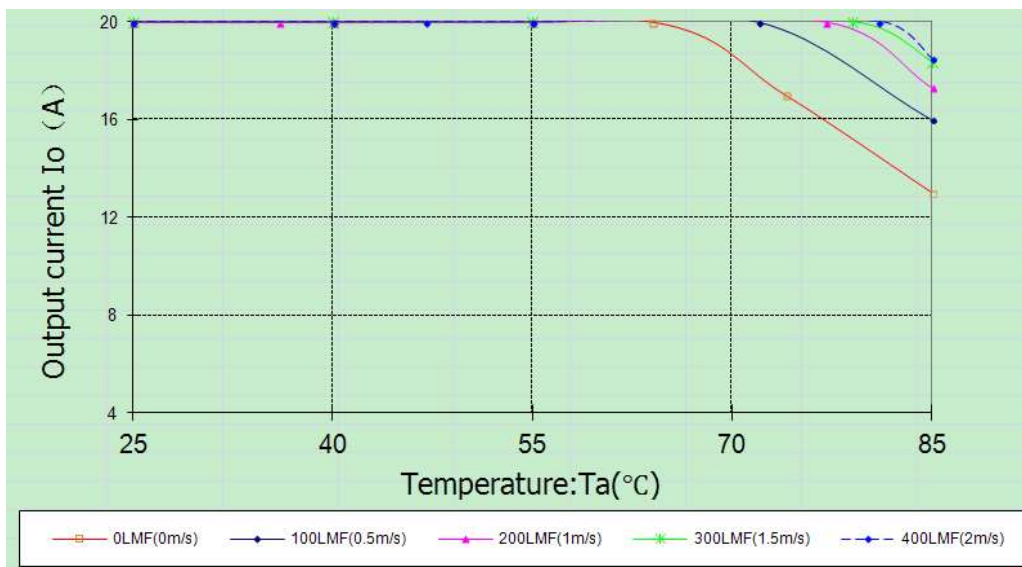
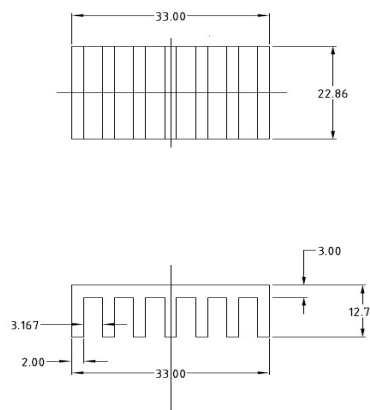


Figure 15 Output power derating, 48Vin, air flowing across the converter from pin 3 to pin 1



Heatsink Mechanical diagram

ENVIRONMENTAL SPECIFICATIONS

Qualification Testing

| Parameter | Unit (pcs) | Test condition |
|------------------|------------|--|
| Halt test | 4-5 | $T_{a,min}$ -30 °C to $T_{a,max}$ +25 °C, 10 °C step, V_{in} = min to max, 0 ~ 100% 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 | -55 °C to 125 °C, unit temperature 20cycles |
| Thermal Cycling | 3 | -40 °C to 85 °C, temperature change rate: 1°C/min, cycles: 2cycles |
| Humidity | 3 | 40 °C, 95%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.

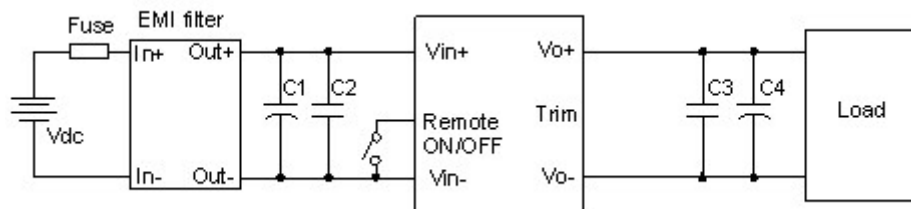


Figure 16 Typical application

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

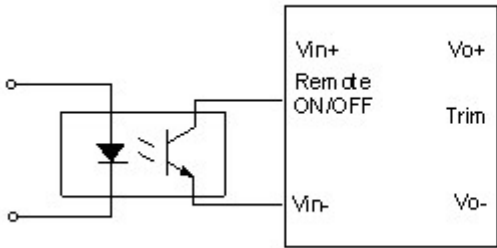
Fuse: External fast blow fuse with a rating of 5A. The recommended fuse model is 0451005.MRSN from LITTLEFUSE.

APPLICATION NOTES

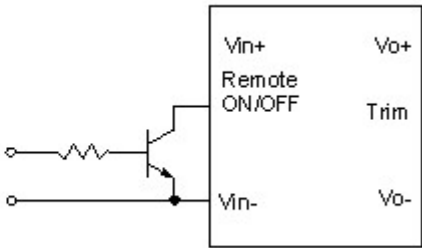
Remote ON/OFF

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 Vin- 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.



Isolated remote ON/OFF circuit



Non-isolated remote ON/OFF circuit

Figure 17 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.

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

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

Δ : Output rate against nominal output voltage.

$$\Delta = \left| \frac{100 \times (V_{nom} - V_o)}{V_{nom}} \right|$$

V_{nom} : Nominal output voltage.

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

$$\Delta = \left| \frac{100 \times (V_{nom} - V_o)}{V_{nom}} \right| = \frac{100 \times (5.5 - 5)}{5} = 10$$

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

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

Internal side

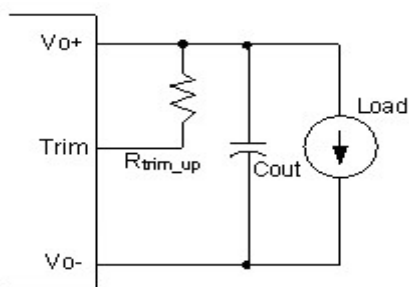


Figure 18 Trim up

Internal side

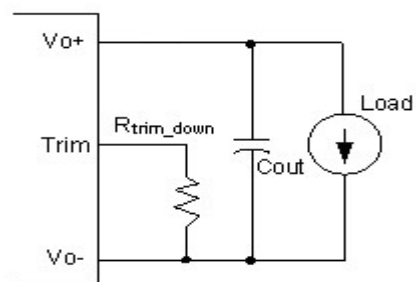


Figure 19 Trim down

APPLICATION NOTES

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

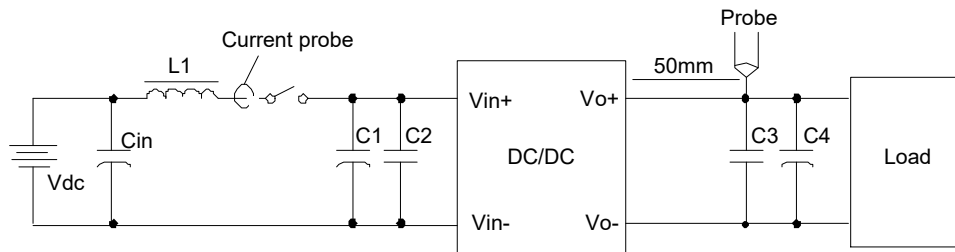


Figure 20 Input ripple & inrush current output ripple & noise test configuration

Vdc: DC power supply

L1: 12uH

Cin: 220uF/100V typical

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

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

C4: 470uF 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

APPLICATION NOTES

Package Information

Package type

moisture sensitivity level 3, moisture barrier bags.

Minimal package QTY

192 pcs.

Package disassembly

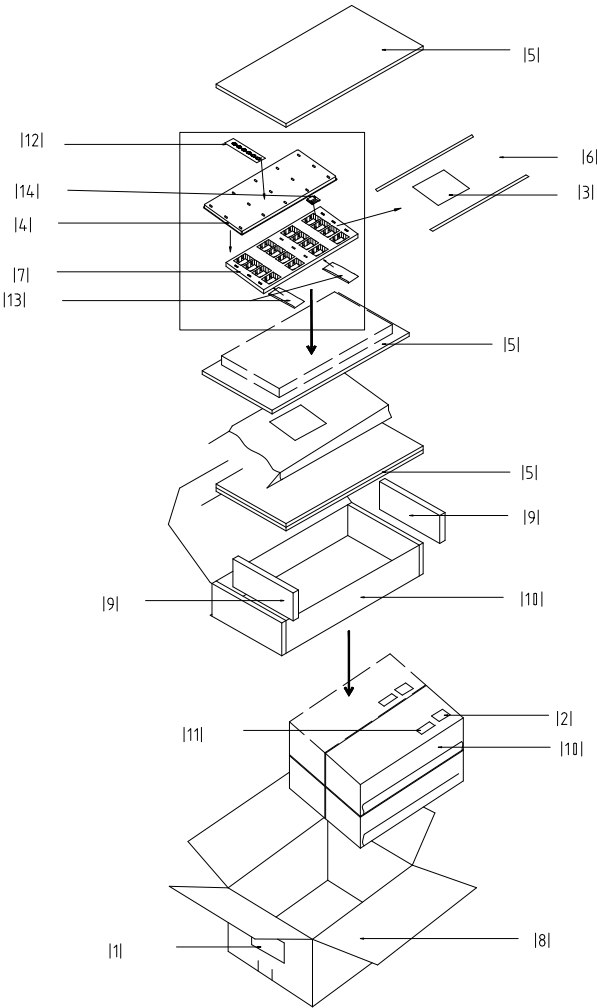


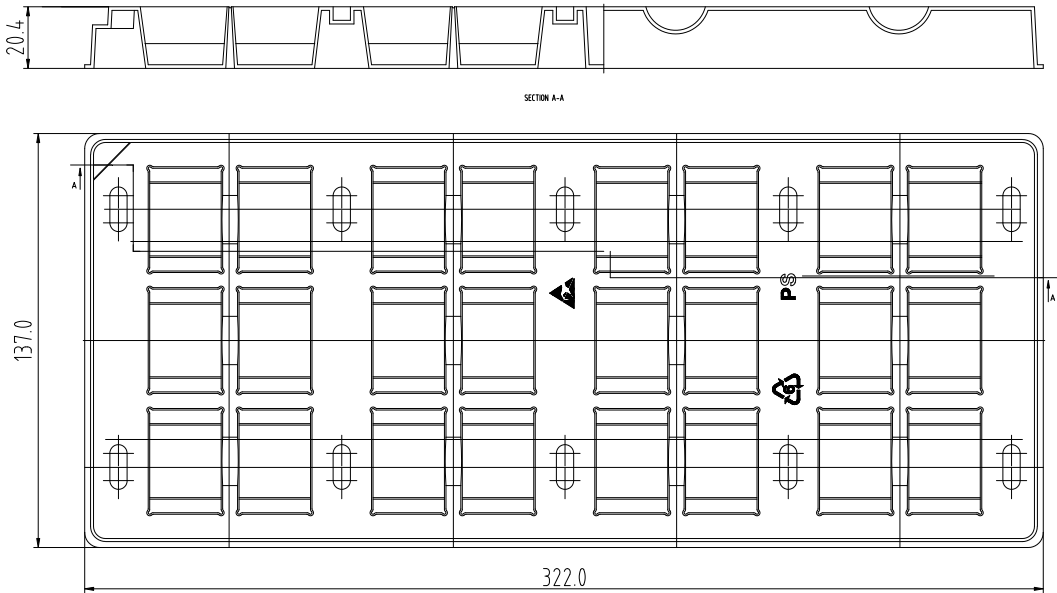
Figure 21 Package disassembly

APPLICATION NOTES

Package Information

| Table 7. Assemblies description | |
|---------------------------------|-------------------------------------|
| No. | Description |
| 1 | Shipping label |
| 2 | Moisture proof 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



SOLDERING INFORMATION

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 simulative.

Assembly

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

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 |
| 1.9 | 05.28.2020 | Update safety cert from 60950 to 62368-1 | E.Wang |
| 2.0 | 05.11.2021 | Update the template | J. Zhang |
| 2.1 | 10.13.2021 | Update Trim formula | K. Wang |



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PRECISION | POWER | PERFORMANCE

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