

AVD50B-48S12

50 Watts

Sixteenth-brick Converter

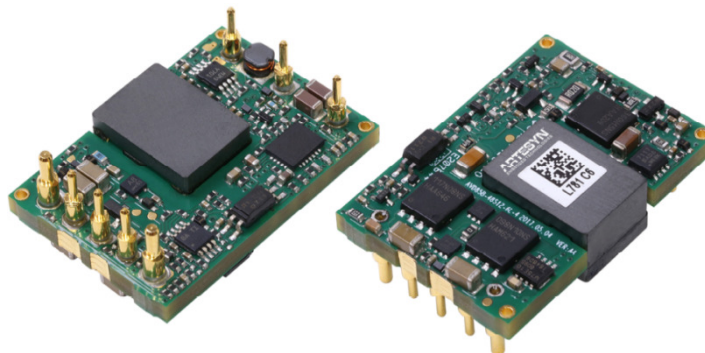
Total Power: 50 Watts
Input Voltage: 36 to 75 Vdc
of Outputs: Single

Special Features

- Delivering up to 4.17A output current
- Ultra-high efficiency 93% typ. at full load
- Wide input range: 36V ~ 75V
- Excellent thermal performance
- No minimum load requirement
- Basic isolation
- High power density
- Low output noise
- RoHS Directive(EU) 2015/863 (RoHS 3.0)
- Startup Pre-bias
- Remote control function
- Remote output sense
- Trim function: 80% ~ 110%
- Input under voltage lockout
- Output over current protection
- Output short protection
- Output over voltage protection
- Over temperature protection
- Industry standard sixteenth-brick pin-out outline
- SMT or through-hole option

Safety

EN 62368-1
CE Mark
UL/TUV
Materials meet UL94, V-0 flammability rating
EN55032 ClassA with external filter



Product Descriptions

The AVD50B-48S12 is a single output DC/DC converter with standard sixteenth-brick outline and pin configuration. It delivers up to 4.17A output current with 12V output voltage. Above 93% ultra-high efficiency and excellent thermal performance make it an ideal choice to supply power in telecom and datacom.

Applications

Telecom/ Datacom

Model Numbers

Standard	Output Voltage	Output Current	Structure	Remote ON/OFF logic	RoHS Status
AVD50B-48S12B-6L	12Vdc	4.17A	Baseplate	Negative	RoHS Directive(EU) 2015/863 (RoHS 3.0)
AVD50B-48S12-6L	12Vdc	4.17A	Open-frame	Negative	RoHS Directive(EU) 2015/863 (RoHS 3.0)
AVD50B-48S12TL	12Vdc	4.17A	Open-frame	Negative	RoHS Directive(EU) 2015/863 (RoHS 3.0)

Ordering information

AVD50B	-	48	S	12	P	B	-	6	L
①		②	③	④	⑤	⑥	⑦	⑧	⑨

①	Model series	AVD: high efficiency sixteenth brick series, 50: output power 50W
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	-	Need "-" for through-hole unit, to separate the data of voltage and pin length, omit for SMT unit
⑧	Pin length	T: SMT; 6: 3.8mm ± 0.25mm pin length
⑨	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	All	$V_{IN,DC}$	-	-	80	Vdc
Operating -Continuous	All		-	-	100	Vdc
Non-operating -100mS						
Ambient Operating Temperature	All	T_A	-40	-	+85	°C
Isolation Voltage ¹	All		-	-	2250	Vdc
Input to output						
Storage Temperature	All	T_{STG}	-55	-	+125	°C
Voltage at remote ON/OFF pin	All		-0.3	-	12	Vdc
Humidity (non-condensing)	All		-	-	95	%
Operating			-	-	95	%
Non-operating						

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	$I_O = I_{O,max}$ $V_{IN,DC} = 36V_{DC}$	$I_{IN,max}$	-	-	2	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	$I_{IN,typ}$	-	25	-	mA
Operating Efficiency	$I_O = I_{O,max}$ $I_O = 50\% * I_{O,max}$	η	-	93 89	-	%

Note 1 - $T_a = 25^\circ C$, airflow rate = 400 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	$V_{IN,DC} = 48V_{DC}$ $I_O = 50\% \cdot I_{O,max}$	V_O	11.88	12	12.12	Vdc
Output Voltage Line Regulation	All	$\pm\%V_O$	-	0.063	-	%
		$\pm V_O$	-	7.5	-	mV
Output Voltage Load Regulation	All	$\pm\%V_O$	-	0.063	-	%
		$\pm V_O$	-	7.5	-	mV
Output Voltage Temperature Regulation	All	$\%V_O$	-	-	0.02	%/°C
Output Voltage Trim Range	All	V_O	9.6	-	13.2	V
Output Ripple, pk-pk	Measure with a 1uF ceramic capacitor in parallel with a 10uF tantalum capacitor, 0 to 20MHz bandwidth	V_O	-	64	-	mV _{PK-PK}
Output Current	All	I_O	0	-	4.17	A
Output DC current-limit inception ²	All	I_O	5	-	8	A
V_O Load Capacitance ³	All	C_O	220	-	3300	uF
V_O Dynamic Response Peak Deviation Settling Time	25%~50%~25% or 50%~75%~50% 25% load change slew rate = 0.1A/us	$\pm V_O$ T_s	- -	60 50	- -	mV uSec
	25%~50%~25% or 50%~75%~50% 25% load change slew rate = 1A/us	$\pm V_O$ T_s	- -	70 100	- -	mV uSec

Note 1 - $T_a = 25^\circ\text{C}$, airflow rate = 400 LFM, $V_{in} = 48\text{Vdc}$, nominal V_{out} unless otherwise noted.

Note 2 - Hiccup: auto-restart when over-current condition is removed.

Note 3 - High frequency and low ESR is recommended.

Output Specifications

Table 3. Output Specifications, con't:

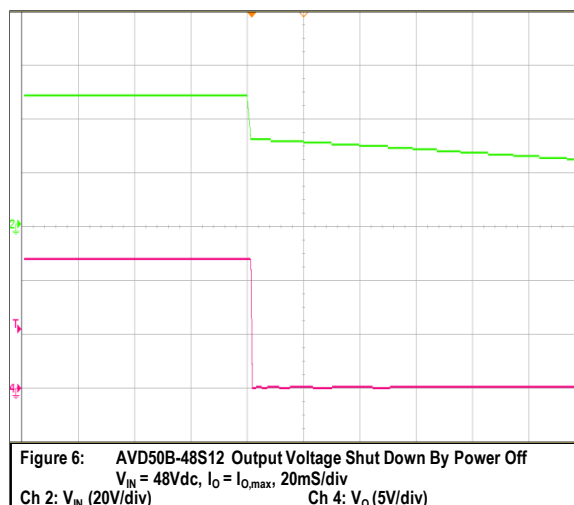
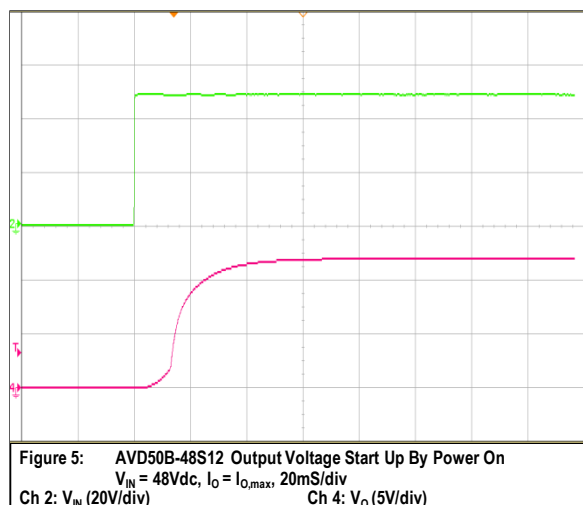
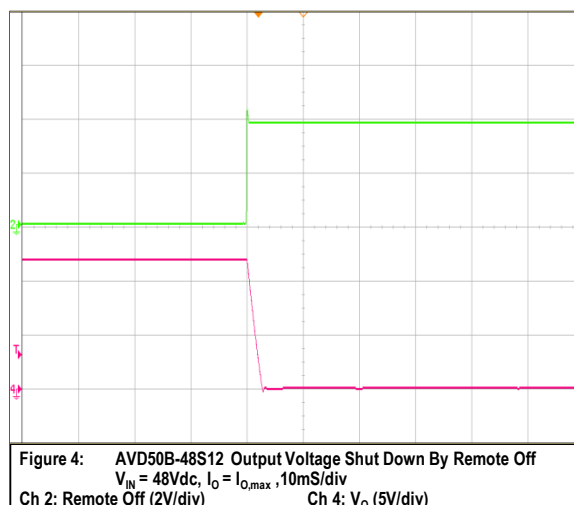
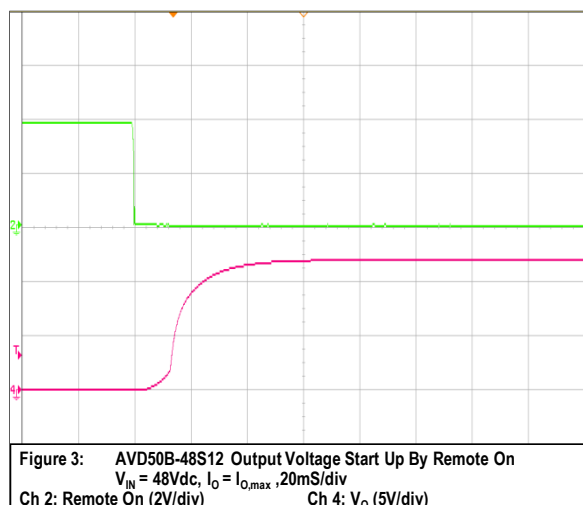
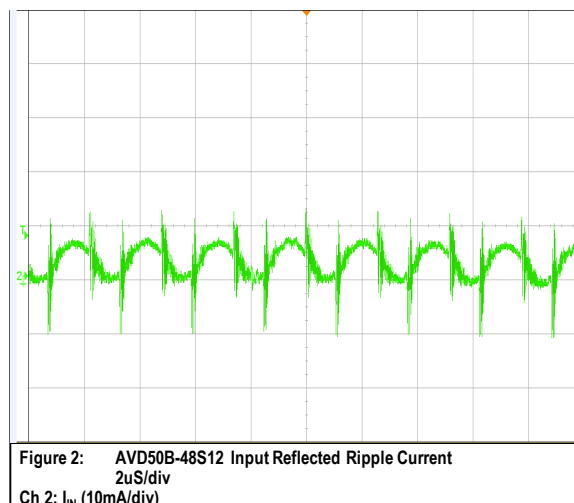
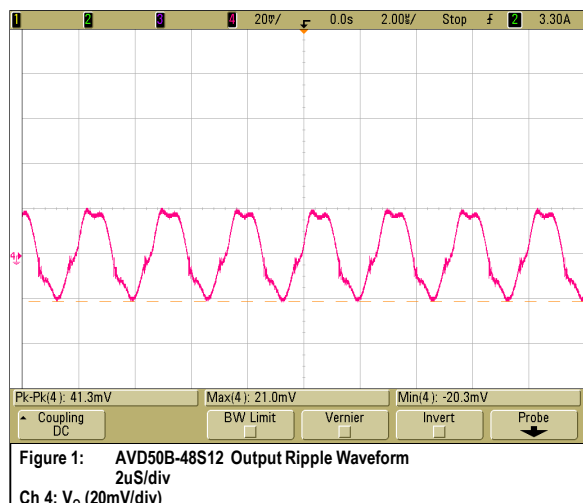
Parameter		Conditions	Symbol	Min	Typ	Max	Unit
Turn-on transient	Rise time	$I_O = I_{O,max}$	T_{rise}	-	20	-	mS
	Turn-on delay time	$I_O = I_{O,max}$	$T_{turn-on}$	-	10	-	mS
	Output voltage overshoot	$I_O = 0$	$\%V_O$	-	-	5	%
Switching frequency		All	Fsw	-	350	-	kHz
Remote ON/OFF control (positive logic)	Off-state voltage	All		-0.3	-	1.2	V
	On-state voltage	All		3.5	-	12	V
Remote ON/OFF control (Negative logic)	Off-state voltage	All		3.5	-	12	V
	On-state voltage	All		-0.3	-	1.2	V
Output over-voltage protection ⁴		Static	V_O	14	-	16.8	V
		Dynamic		14	-	17.0	
Output over-temperature protection ⁵		All	T	-	120	-	°C
Output over-temperature hysteresis		All	T	-	10	-	°C
+ Sense		All	$\%V_O$	-	-	5	%
- Sense		All	$\%V_O$	-	-	5	%
MTBF ⁶		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.

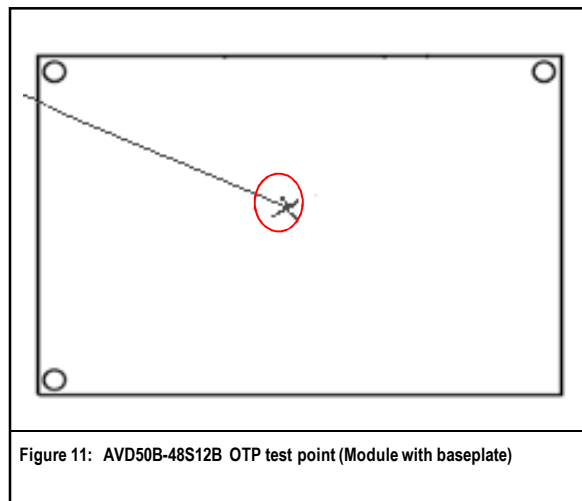
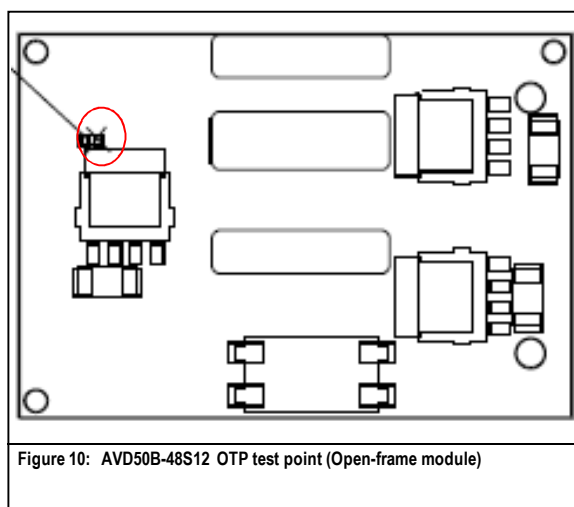
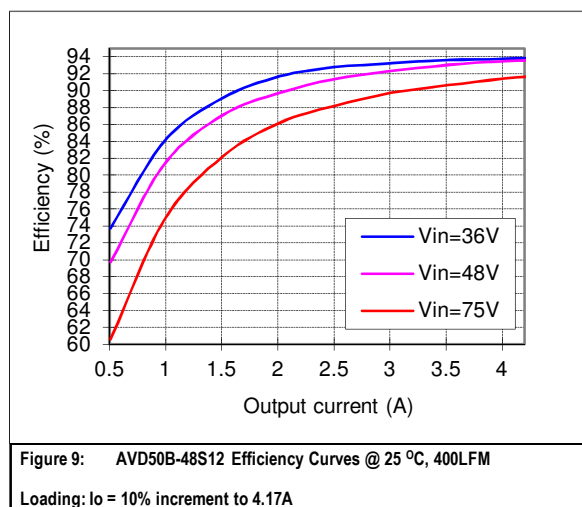
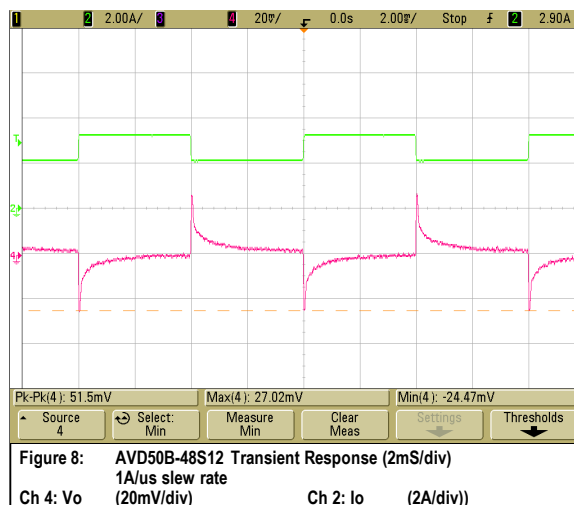
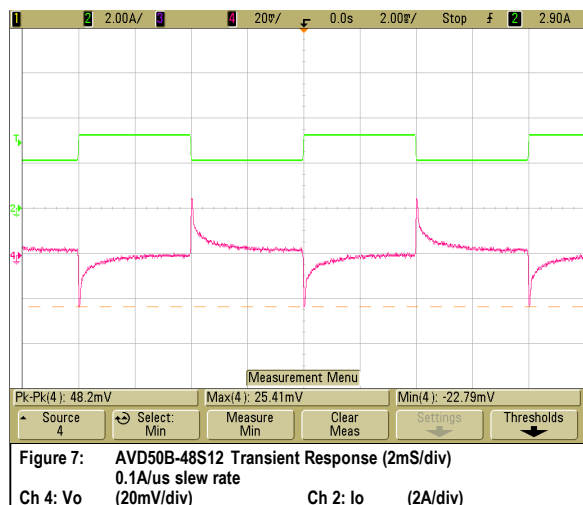
Note 5 - Auto recovery. over-temperature protect(OTP) test point: see Figure 10 and Figure 11.

Note 6 - 300LFM, 40°C, 48Vdc input voltage, 80%* $I_{O,max}$

AVD50B-48S12 Performance Curves

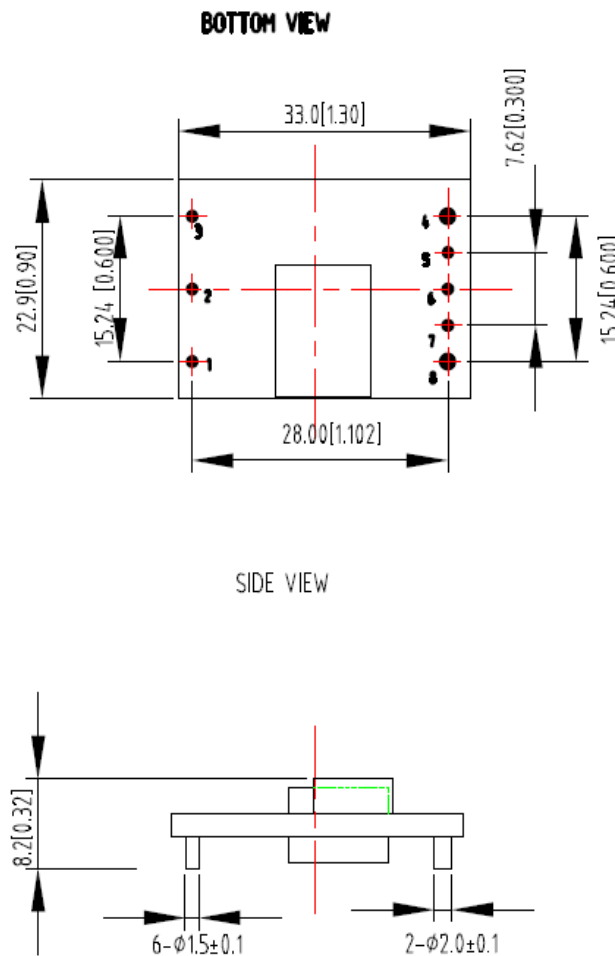


AVD50B-48S12 Performance Curves



Mechanical Specifications

Mechanical Outlines – Surface Mounted Module



UNIT: mm[inch]

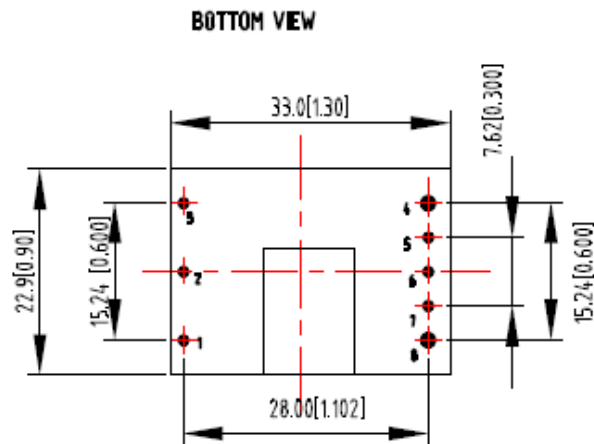
TOLERANCE: X.Xmm ± 0.5 mm[X.XX in. ± 0.02 in.]

X.XXmm ± 0.25 mm[X.XXX in. ± 0.01 in.]

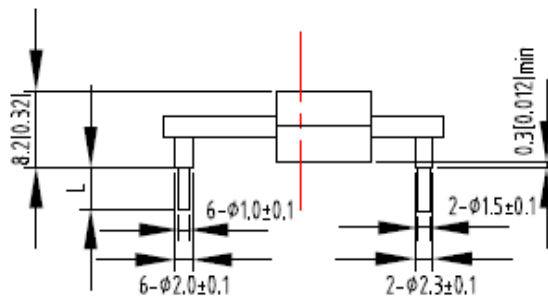
Figure 12 Mechanical Outlines for Surface Mounted Module

Mechanical Specifications

Mechanical Outlines – Open Frame Module



SIDE VIEW



UNIT: mm[inch]

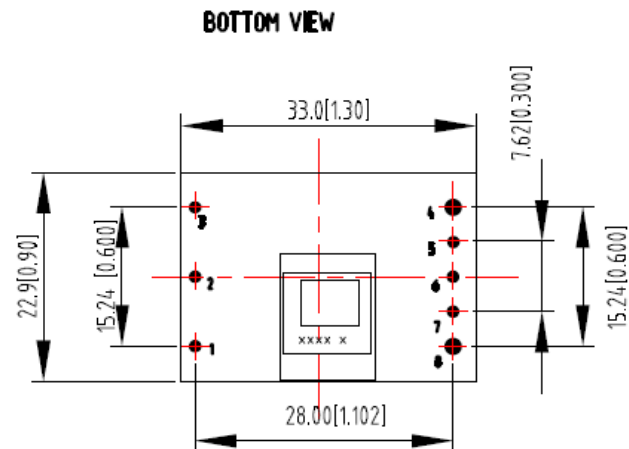
TOLERANCE: X.Xmm±0.5mm[X.XX in.±0.02in.]

X.XXmm±0.25mm[X.XXX in.±0.01in.]

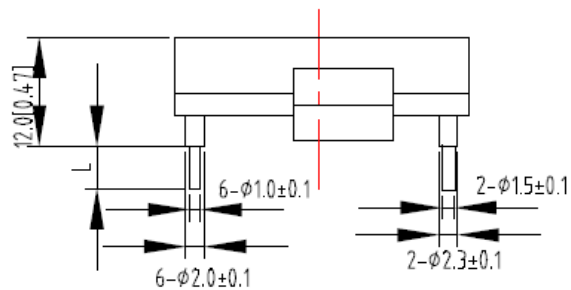
Figure 13 Mechanical Outlines for Open Frame Module

Mechanical Specifications

Mechanical Outlines – Baseplate Module



SIDE VIEW



UNIT: mm[inch]

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

X.XXmm ± 0.25 mm[X.XXX in. ± 0.01 in.]

Figure 14 Mechanical Outlines for Baseplate Module

Pin Length Option

Device code suffix	L
-4	4.8mm $\pm$ 0.25 mm
-6	3.8mm $\pm$ 0.25 mm
-8	2.8mm $\pm$ 0.25 mm
None	5.8mm $\pm$ 0.25 mm

Pin Designations

Pin No	Name	Function
1	Vin+	Positive input terminal
2	Remote On/Off	Remote control terminal
3	Vin-	Negative input terminal
4	Vo-	Negative output terminal
5	S-	Negative remote sense terminal
6	Trim	Output voltage trim terminal
7	S+	Positive remote sense terminal
8	Vo+	Positive output terminal

Environmental Specifications

EMC Immunity

AVD50B-48S12 series power supply is designed to meet the following EMC immunity specifications:

Table 4. Environmental Specifications:

Document	Description	Criteria
EN55032, Class A Limits	Conducted and Radiated EMI Limits, DC input port	/
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, Level 3	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Electrical Fast Transient. DC input port.	B
IEC/EN 61000-4-5	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Immunity to surges - 600V common mode and 600V differential mode for DC ports	B
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.

Safety Certifications

The AVD50B-48S12 series power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 5. Safety Certifications for AVD50B-48S12 series power supply system:

Document	File #	Description
UL/CSA 60950	E132002-A441-UL X13	US and Canada Requirements
EN60950	B 17 11 13890 02899	European Requirements
CE	2375	CE Marking
EN 62368-1	B 013890 3165	European Requirements

Operating Temperature

The AVD50B-48S12 series power supply 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

The converter is designed to operate in different thermal environments and sufficient cooling must be provided. Proper cooling of the DC/DC converter can be verified by measuring the temperature at the test point as shown in the Figure 15. The temperature at this point should not exceed the max values in the table 6.

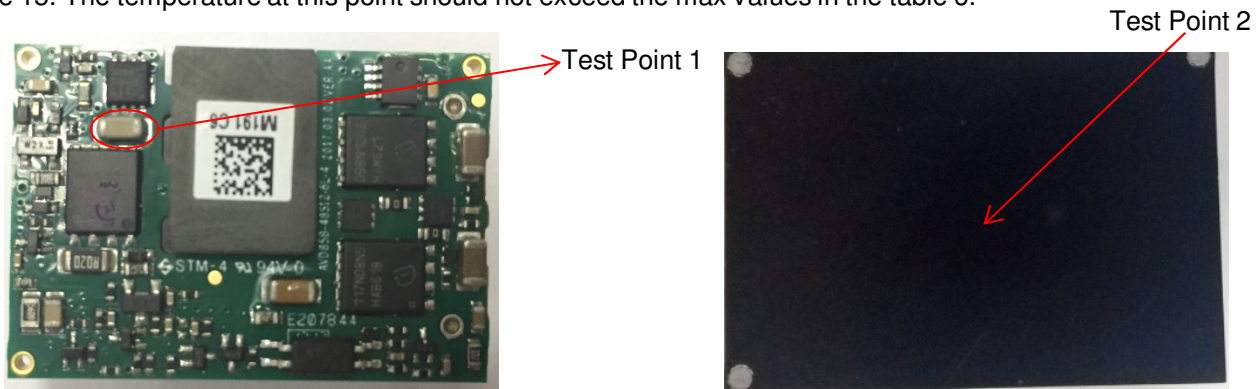


Figure 15 Temperature test point

Table 6. Temperature limit of the test point:

Test Point	Temperature Limit
Test point 1 (C3)	135°C
Test point 2 (Baseplate)	120°C

Thermal Considerations – Con't

For a typical application, below are the derating curves show the derating of output current vs. ambient air temperature at different air velocity. The airflow direction is from Vin- to Vin+.

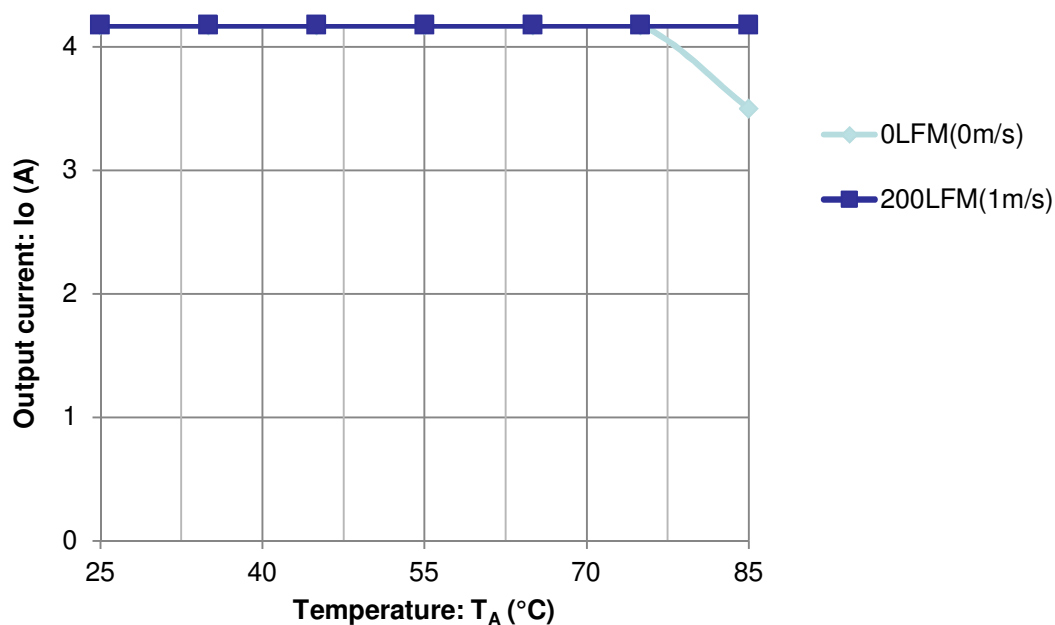


Figure 16 AVD50B-48S12-6L and AVD50B-48S12TL

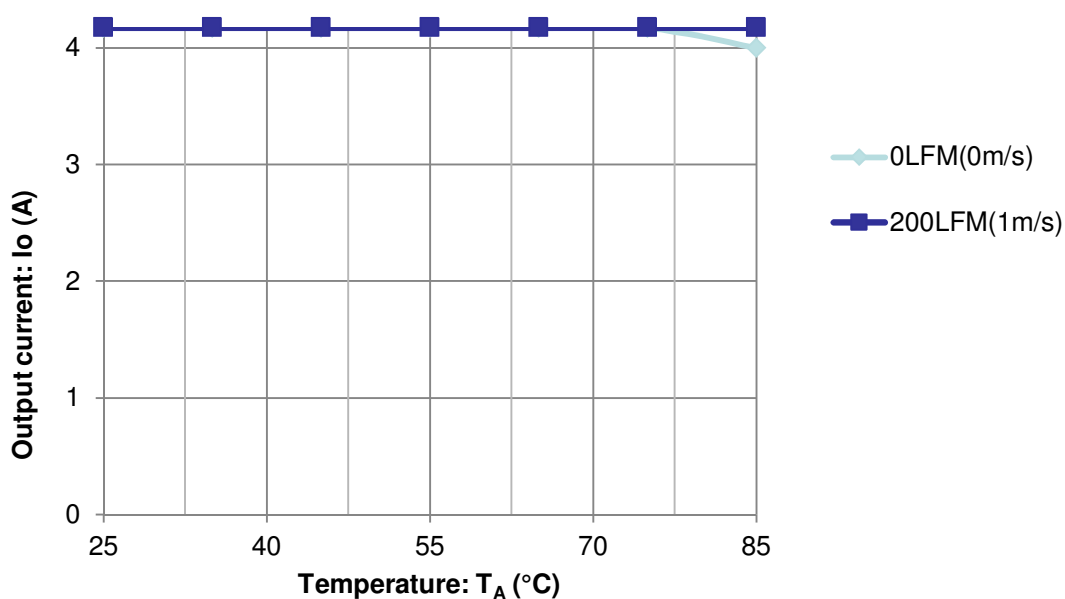


Figure 17 AVD50B-48S12B-6L

Qualification Testing

Parameter	Unit (pcs)	Test condition
Halt test	4-5	$T_{a,min} - 20^{\circ}\text{C}$ to $T_{a,max} + 25^{\circ}\text{C}$, 10°C step, V_{in} = min to max, 0 ~ 100% load
Vibration	3	Frequency range: 5Hz ~ 20Hz, 20Hz ~ 200Hz, A.S.D: $1.0\text{m}^2/\text{s}^3$, -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 20 cycles
Thermal Cycling	3	-40°C to 55°C , temperature change rate: $1^{\circ}\text{C}/\text{min}$, 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 AVD50B-48S12 series power supply.

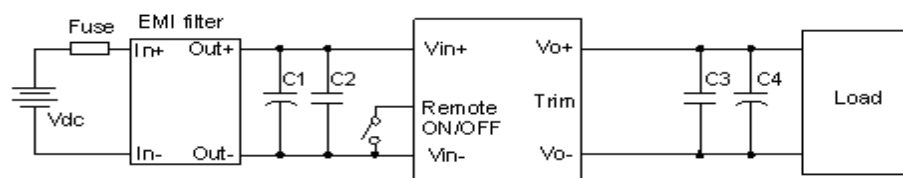


Figure 18 Typical application

C1: 220uF/100V electrolytic capacitor, P/N: UPM2A101MPD (Nichicon) or equivalent caps.

C2: 0.1uF/100V X7R ceramic capacitor, P/N: C3216X7R2A104KT0L0S (TDK) or equivalent caps.

C3: 1uF/100V X7R ceramic capacitor, P/N: C3216X7R2A105KT0L0U (TDK) or equivalent caps.

C4: 220μF oscon capacitor, P/N: CUXAE1C221M2BA (Sanyo).

Fuse: External fast blow fuse with a rating of 5A. The recommended fuse model is 0453005.MR from LITTLEFUSE.

EMI filter: see Figure 23.

48V input and full load output are default.

Remote ON/OFF

Negative remote ON/OFF logic is available in AVD50B-48S12. 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 19.

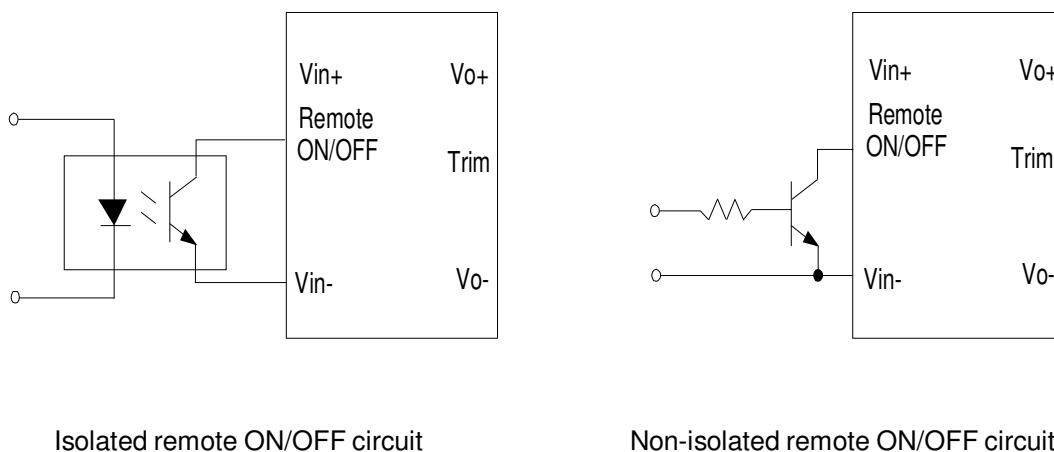


Figure 19 External Remote ON/OFF circuit

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 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 13.2V output, the trimming resistor is

$$\Delta = \frac{100 \times (V_o - V_{o,nom})}{V_{o,nom}} = \frac{100 \times (13.2 - 12)}{12} = 10$$

$$R_{adj-up} = \frac{5.1 \times 12 \times (100 + 10)}{1.225 \times 10} - \frac{510}{10} - 10.2 = 488.35(K\Omega)$$

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

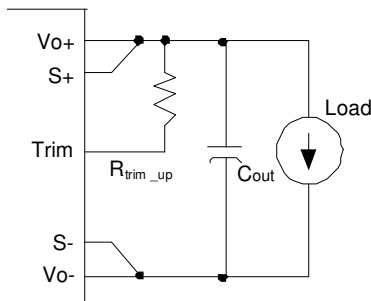


Figure 20 Trim up

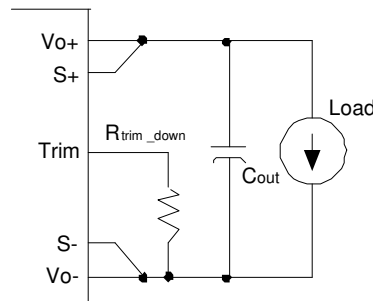


Figure 21 Trim down

If the sense compensate function is not necessary, connect S+ to Vo+ and S- to Vo- directly.

The diagram illustrates a power supply system for a DC/DC converter. The input is a DC voltage source V_{dc} connected to a capacitor C_{in} . The output of C_{in} is connected to an inductor $L1$, which is in series with a current probe. The output of the current probe is connected to the input of the DC/DC converter, labeled V_{in+} and V_{in-} . The output of the DC/DC converter is labeled V_{o+} and V_{o-} . The output of the DC/DC converter is connected to a capacitor $C3$, which is in series with a capacitor $C4$. The output of $C4$ is connected to a load. A probe is connected to the output of the DC/DC converter, labeled V_{o+} , with a 50mm distance indicated between the probe and the output terminal.

Soldering

The product is intended for standard manual or wave soldering.

	Product Requirement	Product Name
R6	Wave soldering	AVD50B-48S12B-6L AVD50B-48S12-6L

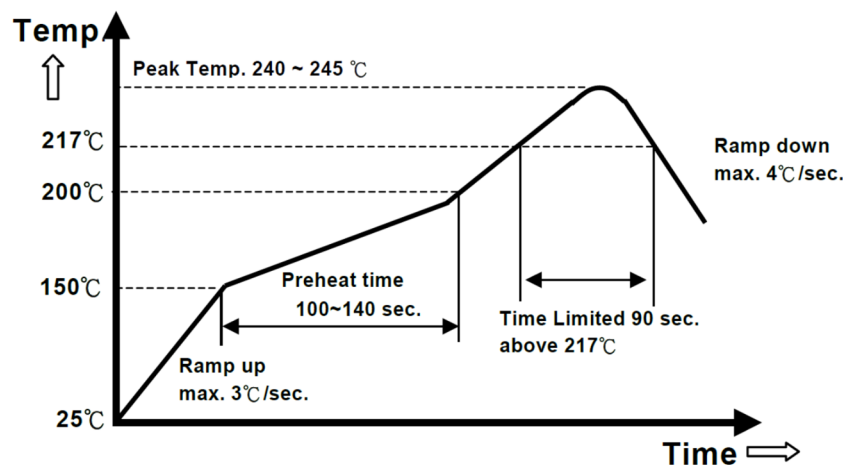
When wave soldering is used, the temperature on pins is specified to maximum 260 °C for maximum 7s.

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.

The below products are intended for standard reflow soldering.

	Product Requirement	Product Name
R6	Reflow soldering	AVD50B-48S12-6L AVD50B-48S12TL

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

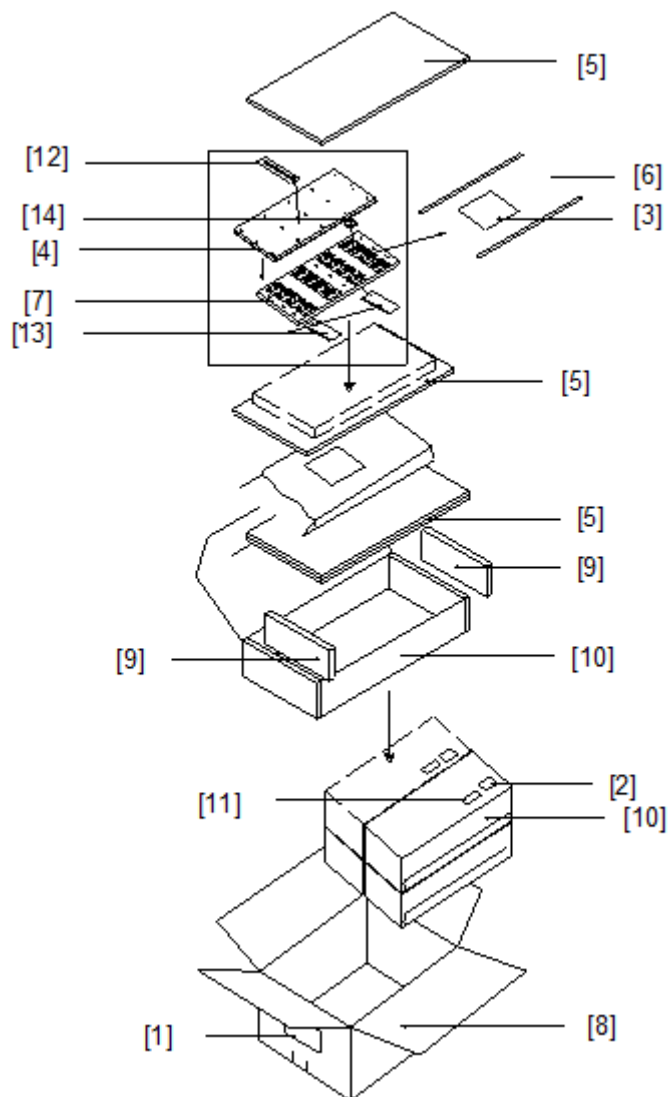
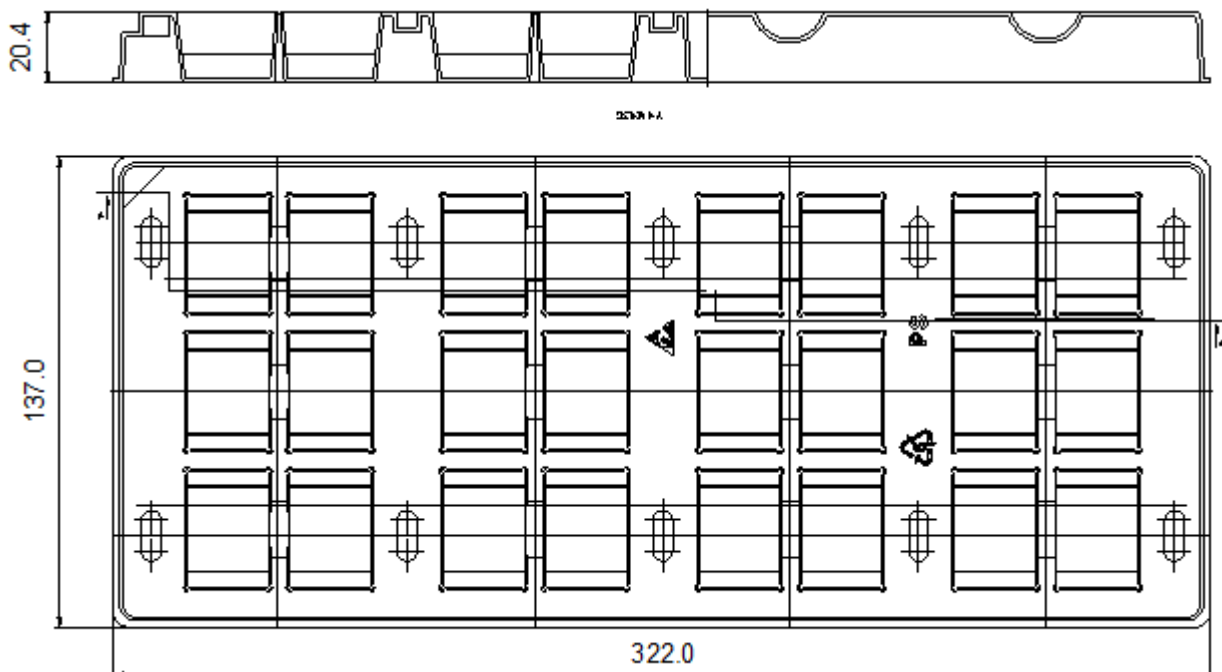


Figure 24 Package disassembly

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



Record of Revision and Changes

Issue	Date	Description	Originators
1.0	08.08.2017	First Issue	L. Lee
1.1	11.21.2017	Update the isolation voltage	L. Lee
1.2	07.10.2018	Update the trim error	K. Wang
1.3	12.09.2019	Update the soldering information	L.Lee
1.4	02.24.2020	Update RoHS information	V.Guo
1.5	06.04.2020	Update 62368-1 cert	L.Lee

WORLDWIDE OFFICES

Americas

2900 South Diablo Way
Suite B100
Tempe, AZ 85282
USA
+1 888 412 7832

Europe (UK)

Ground Floor Offices
Barberry House, 4 Harbour Buildings
Waterfront West, Brierley Hill
West Midlands, DY5 1LN, UK
+44 (0) 1384 842 211

Asia (HK)

14/F, Lu Plaza
2 Wing Yip Street
Kwun Tong, Kowloon
Hong Kong
+852 2176 3333

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For support: productsupport.ep@artesyn.com