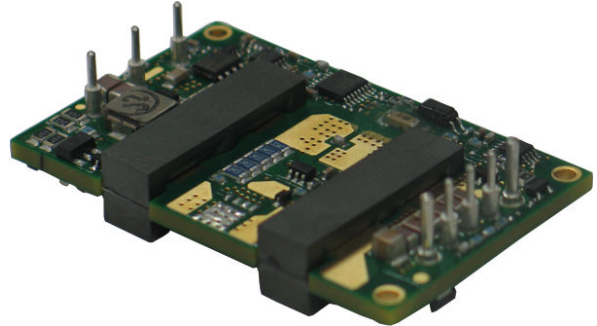


## Description

The AGQ200B-48S2V5 is a single output DC-DC converter with standard quarter-brick outline and pin configuration. It delivers up to 40A output current with 2.5V output voltage. Above 90.5% efficiency and excellent thermal performance make it an ideal choice to supply power in telecom and datacom. It can work under -40°C ~ +85°C.



## Operational Features

- Delivering up to 40A output current
- Ultra-high efficiency 90.5% typ. at full load
- Wide input range: 36V ~ 75V
- Excellent thermal performance
- No minimum load requirement
- Fixed frequency operation
- RoHS 6 compliant

## Control Features

- Remote control function
- Remote output sense
- Trim function: -20% ~ +10%

## Protection Features

- Input under voltage lockout
- Output over current protection
- Output over voltage protection
- Over temperature protection

## Mechanical Features

- Industry standard quarter-brick pin-out outline
- Open frame or baseplate optional
- Pin length option: 3.8mm, 4.8mm, 5.8mm

## Safety & EMC

- Meets safety standards UL 60950-1, CSA-C22.2 NO. 60950-1, IEC/EN 60950-1 and GB4943
- Approved by UL and TUV
- Meets 2006/95/EEC and 93/68/EEC directives which facilitates CE marking in user's end product
- Meets conducted emission's requirements of EN55022 Class A with external filter

## Electrical Characteristics

Full operating ambient temperature range is -40°C to +85°C.

Specifications are subject to change without notice.

| Parameter                                  |                            | Min. | Typ.    | Max. | Unit             | Notes & Conditions                             |
|--------------------------------------------|----------------------------|------|---------|------|------------------|------------------------------------------------|
| <b>Absolute max. ratings</b>               |                            |      |         |      |                  |                                                |
| Input voltage                              | Non-operating              |      |         | 100  | V                | 100ms                                          |
|                                            | Operating                  |      |         | 80   | V                | Continuous                                     |
| Operating temperature                      |                            | -40  |         | 85   | °C               |                                                |
| Storage temperature                        |                            | -55  |         | 125  | °C               |                                                |
| Voltage at remote ON/OFF pin               |                            | -0.7 |         | 12   | V                |                                                |
| <b>Input characteristics</b>               |                            |      |         |      |                  |                                                |
| Operating input voltage range              |                            | 36   | 48      | 75   | V                |                                                |
| Input under-voltage lockout                | Turn-on voltage threshold  | 31   | 34      | 36   | V                |                                                |
|                                            | Turn-off voltage threshold | 30   | 33      | 35   | V                |                                                |
|                                            | Lockout voltage hysteresis | 1    |         | 3    | V                |                                                |
| Max. input current                         |                            |      |         | 3.5  | A                | 36V <sub>in</sub> , full load                  |
| No-load input current                      |                            |      | 0.07    | 0.1  | A                |                                                |
| Standby Input current                      |                            |      | 0.01    | 0.1  | A                | Remote OFF                                     |
| Inrush current transient rating            |                            |      |         | 1    | A <sup>2</sup> s |                                                |
| Input reflected ripple current             |                            |      | 16      | 20   | mA               | Through 12μH inductor; Figure 4                |
| Input voltage ripple rejection             |                            | 40   | 67      |      | dB               | 120Hz                                          |
| Recommended input fuse                     |                            |      |         | 10   | A                | Fast blow external fuse recommended; Figure 11 |
| Input filter component values (C/L)        |                            |      | 6.4\2.2 |      | μF\μH            | Internal values                                |
| Recommended external input capacitance     |                            | 470  |         |      | μF               | Low ESR capacitor recommended; Figure 11       |
| <b>Output characteristics</b>              |                            |      |         |      |                  |                                                |
| Output voltage set point (standard option) |                            | 2.46 | 2.50    | 2.54 | V                | 48V <sub>in</sub> , full load                  |
| Output voltage line regulation             |                            |      | 1.6     | 5    | mV               |                                                |
| Output voltage load regulation             |                            |      | 1.7     | 10   | mV               |                                                |
| Output voltage temperature regulation      |                            |      |         | 0.02 | %/°C             |                                                |

| Parameter                         |                                           | Min. | Typ. | Max.  | Unit    | Notes & Conditions                                          |
|-----------------------------------|-------------------------------------------|------|------|-------|---------|-------------------------------------------------------------|
| Total output voltage range        |                                           | 2.43 | 2.50 | 2.57  | V       |                                                             |
| Output voltage ripple and noise   |                                           |      | 40   | 100   | mVpp    | 20MHz bandwidth; Figure 3                                   |
| Operating output current range    |                                           | 0    |      | 40    | A       |                                                             |
| Output DC current-limit inception |                                           | 44   |      | 56    | A       | Hiccup: auto-restart when over-current condition is removed |
| Output capacitance                |                                           | 470  |      | 10000 | μF      | High frequency and low ESR are recommended                  |
| Dynamic characteristics           |                                           |      |      |       |         |                                                             |
| Dynamic response                  | 25% ~ 50% ~ 25%<br>$I_{o,max}$ , 0.1A/μs  |      | 21   |       | mV      | Figure 5                                                    |
|                                   | Settling time                             |      | 10   |       | μs      | Recovery to within 1% $V_{o,nom}$                           |
|                                   | 25% ~ 50% ~ 25%<br>$I_{o,max}$ , 1A/μs    |      | 160  |       | mV      | Figure 6                                                    |
|                                   | Settling time                             |      | 85   |       | μs      | Recovery to within 1% $V_{o,nom}$                           |
|                                   | 0% ~ 50% ~ 0% $I_{o,max}$ ,<br>0.1A/μs    |      | 85   |       | mV      |                                                             |
|                                   | 10% ~ 100% ~ 10%<br>$I_{o,max}$ , 0.1A/μs |      | 50   |       | mV      |                                                             |
| Turn-on transient                 | Rise time                                 |      | 5    | 30    | ms      | Full load, Figures 9 & 10                                   |
|                                   | Turn-on delay time                        |      | 3    | 10    | ms      |                                                             |
|                                   | Output voltage overshoot                  |      |      | 5     | % $V_o$ |                                                             |
| Efficiency                        |                                           |      |      |       |         |                                                             |
| 100% load                         |                                           |      | 90.3 |       | %       | Figure 1                                                    |
| 50% load                          |                                           |      | 90.6 |       | %       | Figure 1                                                    |

## Electrical Characteristics (Continued)

| Parameter                                                                 | Min. | Typ. | Max. | Unit | Notes & Conditions                                                           |
|---------------------------------------------------------------------------|------|------|------|------|------------------------------------------------------------------------------|
| Isolation characteristics                                                 |      |      |      |      |                                                                              |
| Isolation voltage (conditions:<br>1mA for 60s, slew rate of<br>1500V/10s) |      | 2250 |      | V    | Basic insulation, pollution degree 2,<br>pollution degree 2, input to output |

| Parameter                              |                   | Min. | Typ. | Max. | Unit                | Notes & Conditions                                           |
|----------------------------------------|-------------------|------|------|------|---------------------|--------------------------------------------------------------|
| <b>Feature characteristics</b>         |                   |      |      |      |                     |                                                              |
| Switching frequency                    |                   |      | 280  |      | kHz                 | Regulation stage and Isolation stage                         |
| Remote ON/OFF control (positive logic) | Off-state voltage | 3.5  |      | 12   | V                   | See Figure 12                                                |
|                                        | On-state voltage  | -0.7 |      | 1.2  | V                   |                                                              |
| Remote ON/OFF control (negative logic) | Off-state voltage | 3.5  |      | 12   | V                   |                                                              |
|                                        | On-state voltage  | -0.7 |      | 1.2  | V                   |                                                              |
| Output voltage trim range              |                   | 2.00 |      | 2.75 | V                   | See Trim Characteristics of Application Note                 |
| Output voltage remote sense range      |                   |      |      | 0.5  | V                   |                                                              |
| Output over-voltage protection         |                   | 120  |      | 140  | %V <sub>o,nom</sub> | Hiccup: auto-restart when over-voltage condition is removed  |
| Over-temperature shutdown              |                   | 110  |      | 135  | °C                  | Auto recovery;<br>Test point: see Figure 18                  |
| Over-temperature hysteresis            |                   | 5    |      |      | °C                  |                                                              |
| <b>Reliability characteristics</b>     |                   |      |      |      |                     |                                                              |
| Calculated MTBF (telcordia)            |                   |      | 2    |      | 10 <sup>6</sup> h   | Telcordia SR-332-2006; 80% load, 300LFM, 40°C T <sub>a</sub> |

## Qualification Testing

| Parameter        | Unit (pcs) | Test condition                                                                                                                               |
|------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Halt test        | 4 ~ 5      | T <sub>a,min</sub> -10°C to T <sub>a,max</sub> +10°C, 5°C step, V <sub>in</sub> =min to max, 0 ~ 105% load                                   |
| Vibration        | 3          | Frequency range: 5Hz ~ 20Hz, 20Hz ~ 200Hz, A.S.D: 1.0m <sup>2</sup> /s <sup>3</sup> , -3dB/oct, axes of vibration: X/Y/Z<br>Time: 30min/axis |
| Mechanical shock | 3          | 30g, 6ms, 3axes, 6directions, 3time/direction                                                                                                |
| Thermal shock    | 3          | -40°C to 100°C, unit temperature 20cycles                                                                                                    |
| Thermal cycling  | 3          | -40°C to 55°C, temperature change rate: 1°C/min, cycles: 2cycles                                                                             |
| Humidity         | 3          | 40°C, 95%RH, 48h                                                                                                                             |
| Solder ability   | 15         | IPC J-STD-002C-2007                                                                                                                          |

## Characteristic Curves

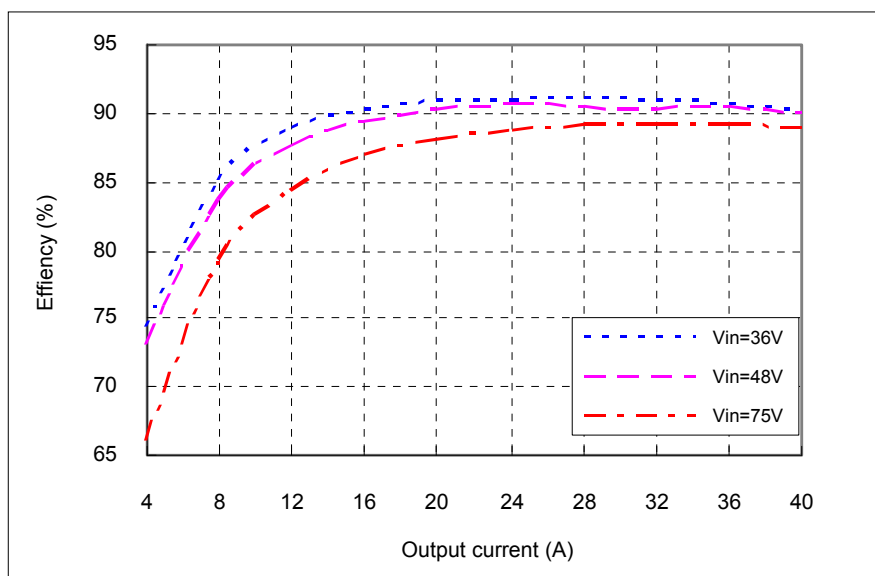


Figure 1 Efficiency vs. output current,  $T_a=25^{\circ}\text{C}$ ,  $V_o=2.5\text{V}$

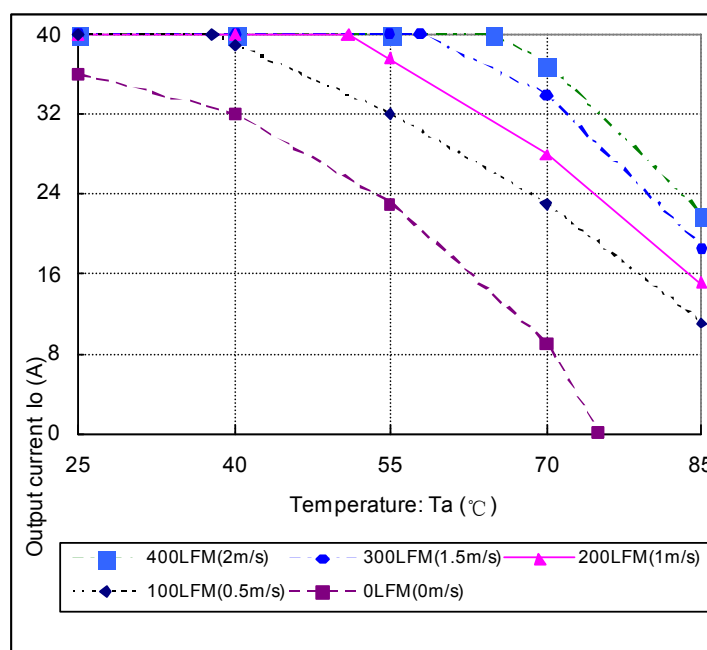


Figure 2 Output power derating,  $48\text{V}_{in}$ , air flowing across the converter from pin 1 to pin 3

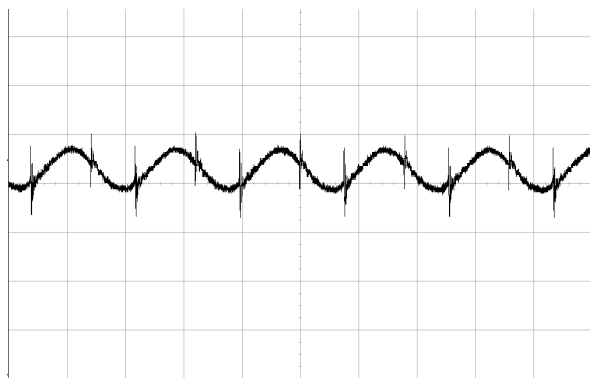


Figure 3 Output ripple & noise (2μs/div, 10mV/div), see Figure 15 for test configuration

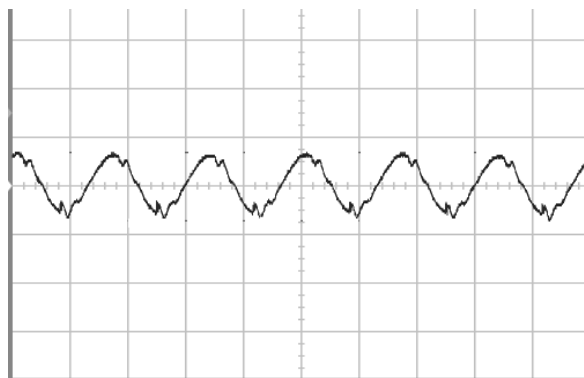


Figure 4 Input reflected ripple current (2μs/div, 5mA/div), see Figure 15 for test configuration

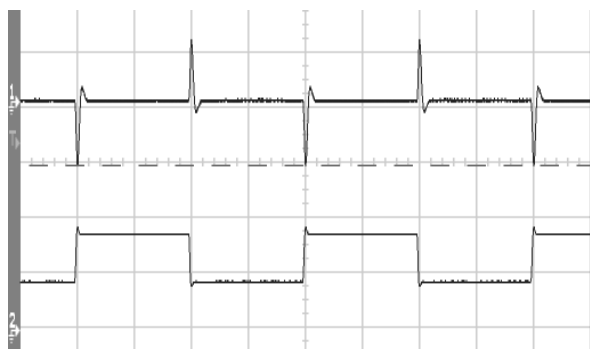


Figure 5 Dynamic response for 25% load step (25% ~ 50% ~ 25%) and 0.1A/μs slew rate, (0.5ms/div), see Figure 11 for test configuration; CH1-output voltage (100mV/div); CH2-output current (20A/div)

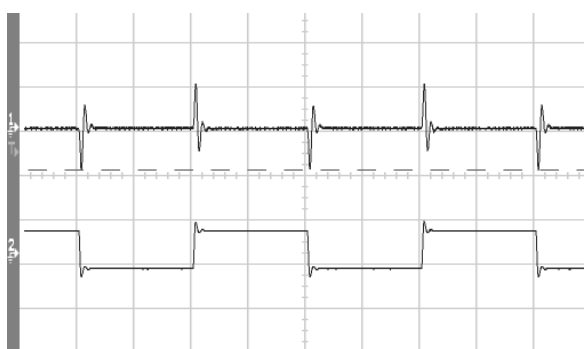


Figure 6 Dynamic response for 25% load step (50% ~ 75% ~ 50%) and 1A/μs slew rate, (0.5ms/div), see Figure 11 for test configuration; CH1-output voltage (200mV/div); CH2-output current (20A/div)

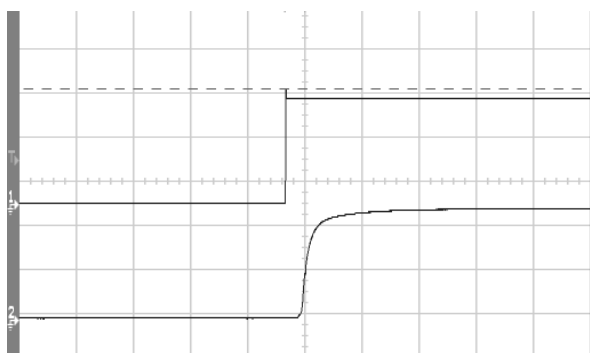


Figure 7 Output voltage startup by power on, (5ms/div), see Figure 11 for test configuration; CH1-input voltage (20V/div); CH2-output voltage (1V/div)

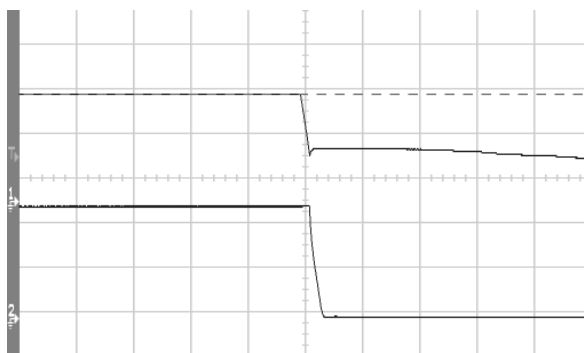


Figure 8 Output voltage shut down by power off, (5ms/div), see Figure 11 for test configuration; CH1-input voltage (50V/div); CH2-output voltage (1V/div)

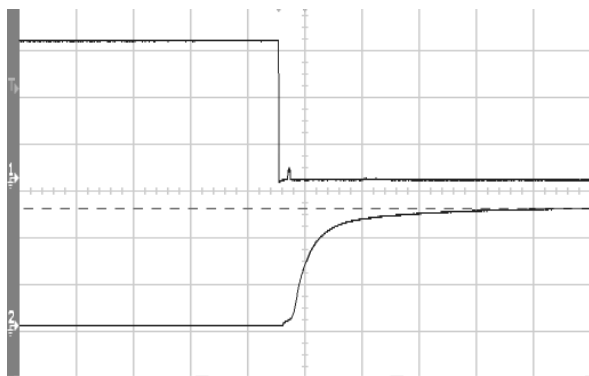


Figure 9 Output voltage startup by remote ON, (2ms/div), see Figure 11 for test configuration; CH1-remote ON (2V/div); CH2-output voltage (1V/div)

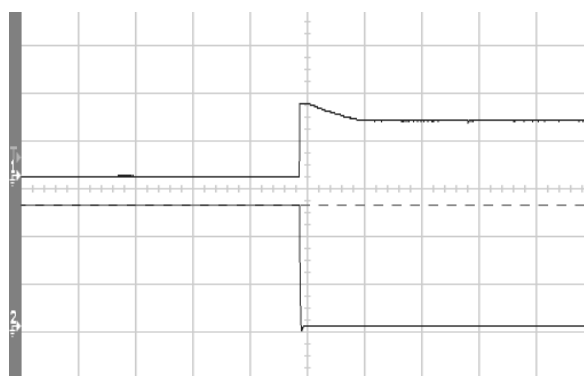


Figure 10 Output voltage shutdown by remote OFF, (2ms/div), see Figure 11 for test configuration; CH1-remote OFF voltage (5V/div); CH2-output voltage (1V/div)

## Application Note

### Typical Application

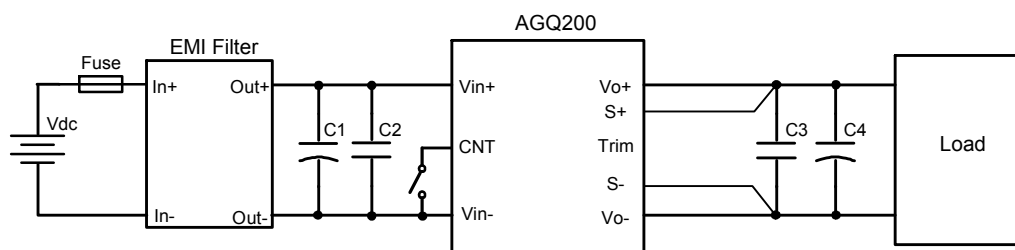


Figure 11 Typical application

C1: 100 $\mu$ F/100V electrolytic capacitor, P/N: UVZ2A101MPD (Nichicon) or equivalent caps

C2: 1 $\mu$ F/100V X7R ceramic capacitor

C3: 1 $\mu$ F/25V X7R ceramic capacitor

C4: 470 $\mu$ F/25V electrolytic capacitor, P/N: UPM1E471MPD (Nichicon) or equivalent caps

External fast blow fuse with a rating of 15A should be used in the application.

If the load is far from the unit, connect S+ and S- to the terminal of the load respectively to compensate the voltage drop on the transmission line.

### Remote ON/OFF

Either positive or negative remote ON/OFF logic is available in AGQ200B-48S2V5. The following figure is the detailed internal circuit and reference in AGQ200B-48S2V5.

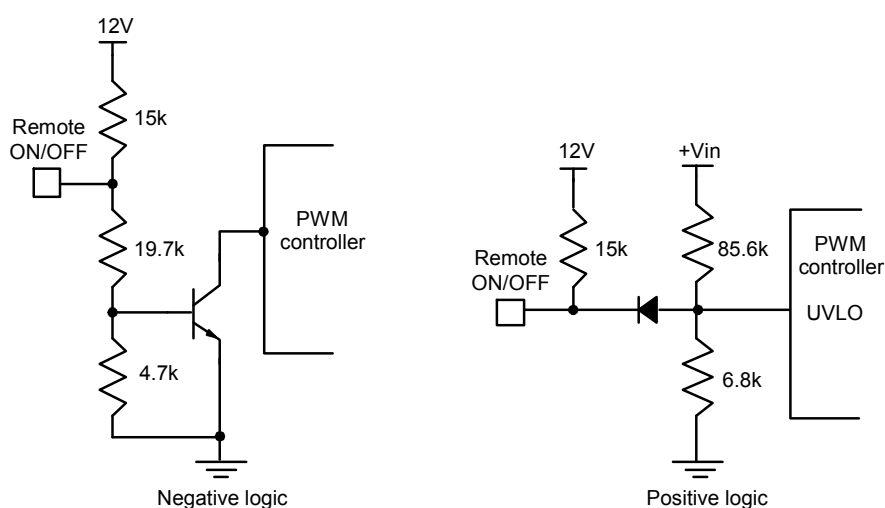


Figure 12 Remote ON/OFF internal diagram

## Trim Characteristics

Connecting an external resistor between Trim pin and  $V_o^-$  pin will decrease the output voltage. While connecting it between Trim and  $V_o^+$  will increase the output voltage. The following equations determine the external resistance to obtain the trimmed output voltage.

$$R_{trim-down} = \frac{510}{\Delta} - 10.2(k\Omega)$$

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

$$\Delta = (V_o - V_{nom}) \times 100 / V_{nom}$$

$V_{nom}$  : Nominal output voltage

For example, to get 2.75V output, the trimming resistor is

$$R_{trim-up} = \frac{5.1 \times 2.5 \times (100 + (2.75 - 2.5) \times 100 / 2.5)}{1.225 \times (2.75 - 2.5) \times 100 / 2.5} - \frac{510}{(2.75 - 2.5) \times 100 / 2.5} - 10.2 = 53.3(k\Omega)$$

The output voltage can also be trimmed by potential applied at the Trim pin.

$$V_o = 1.02V_{trim} + 1.25$$

Where  $V_{trim}$  is the potential applied at the Trim pin, and  $V_o$  is the desired output voltage.

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

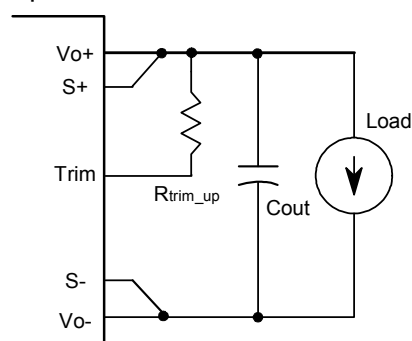


Figure 13 Trim up

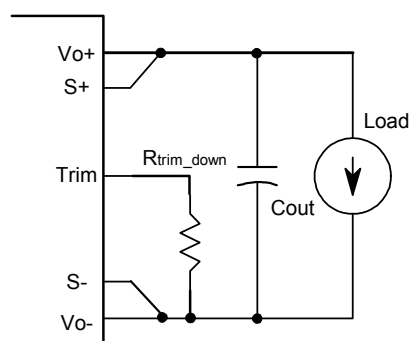


Figure 14 Trim down

## Input Ripple & Inrush Current And Output Ripple & Noise Test Configuration

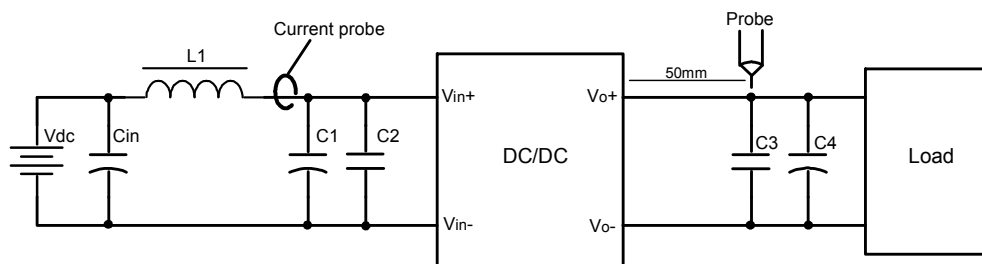


Figure 15 Input ripple & inrush current, ripple & noise test configuration

Vdc: DC power supply

L1: 12 $\mu$ H

Cin: 220 $\mu$ F/100V typical

C1 ~ C4: See Figure 11

## EMC Filter Configuration

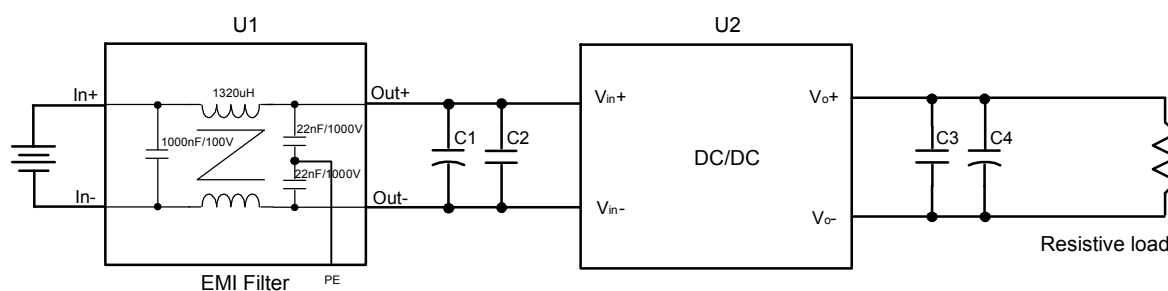


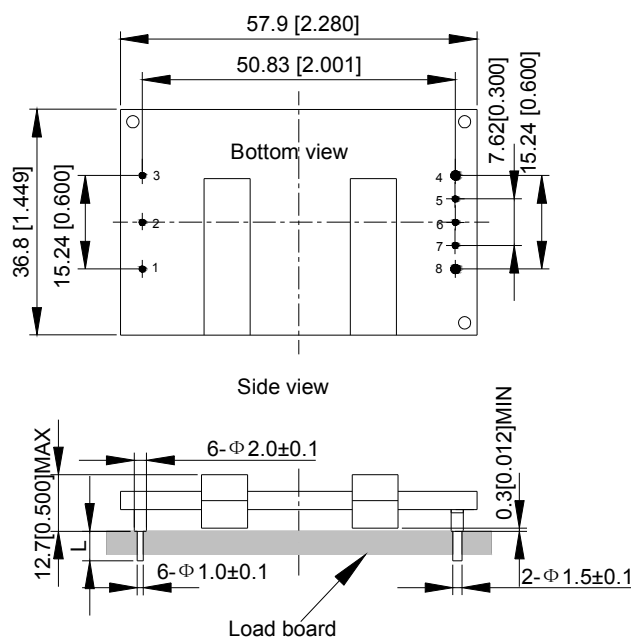
Figure 16 EMC test configuration

U1: 5A input EMC filter module

U2: Module to test, AGQ200B-48S2V5

C1 ~ C4: See Figure 11

## Mechanical Diagram



Unit: mm[inch]

Bottom view: pin on upside

Tolerance: X.Xmm±0.5mm[X.X in.±0.02in.]

X.XXmm±0.25mm[X.XX in.±0.01in.]

Figure 17 Mechanical diagram

## Pin length options

| 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       | $V_{in+}$     | Positive input voltage  |
| 2       | Remote ON/OFF | Remote control          |
| 3       | $V_{in-}$     | Negative input voltage  |
| 4       | $V_{o-}$      | Negative output voltage |
| 5       | S-            | Negative remote sense   |
| 6       | Trim          | Output voltage trim     |
| 7       | S+            | Positive remote sense   |
| 8       | $V_{o+}$      | Positive output voltage |

## Soldering

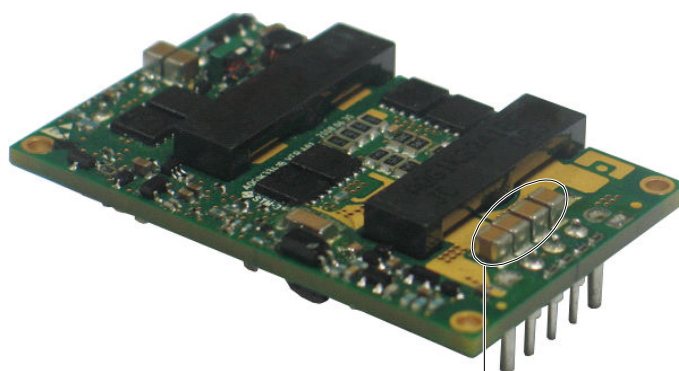
The product is intended for standard manual or wave soldering.

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

When manual soldering is used, 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.

## Thermal Considerations



Note: When the temperature of this test point is lower than 100°C, the module thermal reliability is available

Figure 18 Temperature test point on converter

## Ordering Information

| AGQ200B | - | 48 | S | 2V5 | P | B | - | 4 | L |
|---------|---|----|---|-----|---|---|---|---|---|
| ①       |   | ②  | ③ | ④   | ⑤ | ⑥ |   | ⑦ | ⑧ |

|   |                      |                                                                                             |
|---|----------------------|---------------------------------------------------------------------------------------------|
| ① | Model series         | AGQ: series name, 200B: rated output power 200W. The lower output is limited by its current |
| ② | Input voltage        | 48: 36V ~ 75V input range, rated input voltage 48V                                          |
| ③ | Output number        | S: single output. D: dual output                                                            |
| ④ | Rated output voltage | 2V5: 2.5V output                                                                            |
| ⑤ | Remote ON/OFF logic  | Default: negative logic; P: positive logic                                                  |
| ⑥ | Baseplated           | Baseplated. Default: no baseplate.                                                          |
| ⑦ | Pin length           | -4: 4.8±0.2mm                                                                               |
| ⑧ | RoHS status          | L: RoHS, R6                                                                                 |

| Model number        | Description                                                         |
|---------------------|---------------------------------------------------------------------|
| AGQ200B-48S2V5-4L   | 4.8mm pin length; negative on/off logic; no baseplate; R6 compliant |
| AGQ200B-48S2V5P-4L  | 4.8mm pin length; positive on/off logic; no baseplate; R6 compliant |
| AGQ200B-48S2V5B-4L  | 4.8mm pin length; negative on/off logic; baseplated; R6 compliant   |
| AGQ200B-48S2V5PB-4L | 4.8mm pin length; positive on/off logic; baseplated; R6 compliant   |

## Hazardous Substances Announcement (RoHS Of China)

| Parts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Hazardous substances |    |    |                  |     |      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----|----|------------------|-----|------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Pb                   | Hg | Cd | Cr <sup>6+</sup> | PBB | PBDE |
| AGQ200B-48S2V5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ○                    | ○  | ○  | ○                | ○   | ○    |
| <p>○: Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006</p> <p>√: Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006</p> <p>Emerson Network Power Co., Ltd. has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the hazardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain hazardous substances due to the lack of reliable substitute or mature solution:</p> <ol style="list-style-type: none"> <li>1. Solders (including high-temperature solder in parts) contain plumbum.</li> <li>2. Glass of electric parts contains plumbum.</li> <li>3. Copper alloy of pins contains plumbum</li> </ol> |                      |    |    |                  |     |      |