

Description

The AGQ100C-48S3V3-6Y isolated DC-DC converter (converter for short) is a new DC-DC converter for optimum efficiency and power density. The converter provides up to 25A output current in an industry standard quarter-brick, which makes it an ideal choice for small space, high current and low voltage applications. The converter uses an industry standard quarter-brick: 57.9mm × 36.8mm × 9.7 (2.28" × 1.45" × 0.38") and standard pin-out configuration. It includes extensive control and protection features for maximum flexibility and provides a versatile solution for a whole range of applications with its input voltage range of 36V ~ 75V and it can provide 3.3V@25A single output that are isolated from inputs. The converter can achieve ultra high efficiency and excellent thermal performance, for most applications a heatsink is not required. The converter features fast dynamic response characteristics and low output ripple. This high quality and highly reliable converter is competitively priced and an ideal solution for distributed power, telecoms and datacom applications.

Operational Features

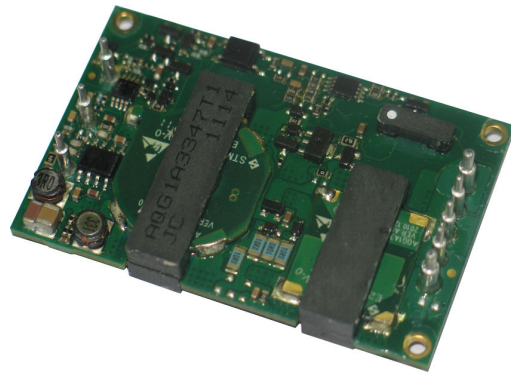
- Delivers up to 25A output current
- Industry standard quarter-brick
- Basic isolation
- Ultra high efficiency
- High power density
- Low output noise
- Industry standard pin-out
- Wide input voltage of 36V ~ 75V
- RoHS 5 compliant

Control Features

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

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
- Pin length option: 3.8mm

Safety & EMC

- Meets basic insulation requirements of IEC/EN/UL/CSA 60950
- UL/CSA 60950 recognized and certified to IEC/EN 60950
- Meets the Low Voltage Directives 2006/95/EEC with the Amendment Directive 93/68/EEC which facilitates CE marking in user's end product
- Approved by UL and TUV

- Materials meet UL94, V-0 flammability rating
- Meets conducted emission's requirements of FCC Class A and 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
Absolute max. ratings						
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		-0.3		12	V	
Input characteristics						
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				2.8	A	36V _{in} , full load
No-load input current				0.15	A	
Standby input current			0.01	0.1	A	Remote OFF
Inrush current transient rating				1	A ² s	Figure 17
Input reflected ripple current				20	mA	Through 12μH inductor; Figure 17
Recommended input fuse				5	A	External fast blow fuse is recommended; Figure 12
Input filter component values (C/L)			2.0/3.0		μF/μH	Internal values
Recommended external input capacitance		100			μF	Low ESR capacitor is recommended; Figure 12
Output characteristics						
Output voltage set point (standard option)		3.25	3.3	3.35	V	48V _{in} , full load
Output voltage line regulation				0.3	%	
				10	mV	

Parameter		Min.	Typ.	Max.	Unit	Notes & conditions
Output voltage load regulation				0.6	%	
				20	mV	
Output voltage temperature regulation				0.02	%/°C	
Total output voltage range		3.201	3.3	3.399	V	Over sample, line, load, temperature & life
Output voltage ripple and noise				100	mVpp	Figure 2 20MHz bandwidth; Figure 17
Operating output current range		0		25	A	
Output DC current-limit inception		27		35	A	Hiccup: auto-restart when over-current condition is removed
Output capacitance		220		10000	μF	High frequency and low ESR are recommended
Dynamic characteristics						
Dynamic response	50% ~ 75% ~ 50% $I_{o,max}$, 0.1A/μs			180	mV	Figure 4 Test condition: 25°C, nominal input voltage, Figure 12
	Settling time			400	μs	Recovery to within 1% $V_{o,nom}$
	50% ~ 75% ~ 50% $I_{o,max}$, 1A/μs			450	mV	Figure 5 Test condition: 25°C, nominal input voltage, Figure 12
	Settling time			400	μs	Recovery to within 1% $V_{o,nom}$
Turn-on transient	Rise time			30	ms	Full load, Figure 6
	Turn-on delay time			30	ms	
	Output voltage overshoot			5	% V_o	
Efficiency						
100% load			88.5		%	Figure 1
50% load			87.8		%	Figure 1

Electrical Characteristics (Continued)

Parameter		Min.	Typ.	Max.	Unit	Notes & conditions
Isolation characteristics						
Isolation voltage (conditions: 1mA for 60s, slew rate of 1500V/10s)		1500			V	Basic insulation, pollution degree 2, input to output
		1500			V	Basic insulation, pollution degree 2, input to baseplate
		500			V	Functional insulation, pollution degree 2, output to baseplate
Feature characteristics						
Switching frequency		320	340	360	kHz	
Remote ON/OFF control (positive logic)	Off-state voltage	-0.7		0.8	V	Figure 13 and Figure 14
	On-state voltage	3.5		12	V	
Remote ON/OFF control (negative logic)	Off-state voltage	3.5		12	V	
	On-state voltage	-0.7		0.8	V	
Output voltage trim range		2.64		3.63	V	See <i>Trim Characteristics</i> in <i>Application Note</i>
Output voltage remote sense range				0.33	V	
Output over-voltage protection		120	130	150	% $V_{o,nom}$	Hiccup: auto-restart when over-voltage condition is removed
Over-temperature shutdown		115	130	135	°C	Auto recovery; over-temperature protect (OTP) test point: Figure 11 Tested under thermal balance condition
Over-temperature hysteresis			13		°C	
Reliability characteristics						
Calculated MTBF (telcordia)			2.5		10^6 h	Telcordia SR-332-2006; 80% load, 300LFM, 40°C T_a

Electromagnetic Compatibility Requirements

Test item	Regulations	Criteria	Notes & conditions
Conducted emission	EN 55022 DC input port, class A limits	N/A	See <i>EMC Test Conditions</i>
Immunity to electrostatic discharge	IEC/EN61000-4-2 Enclosure port, level 3	B	
Immunity to electrical fast transient	IEC/EN61000-4-4 DC input port, level 3	B	
Immunity to surges	IEC/EN61000-4-5 DC input port Line to ground (earth): 600V Line to line: 600V	B	
Immunity to continuous conducted interference	IEC/EN61000-4-6 DC input port, level 2	A	
Immunity to voltage dips and short interruptions and voltage variations	EN 61000-4-29 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 disturbance ceases, 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.

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 to hardware.

Qualification Testing

Parameter	Unit (pcs)	Test condition
Halt test	4 ~ 5	$T_{a, \min} - 10^{\circ}\text{C}$ to $T_{a, \max} + 10^{\circ}\text{C}$, 5°C step, $V_{in} = \text{min. to max.}$, 0 ~ 105% 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: 30 min/axes
Mechanical shock	3	30g, 6ms, 3 axes, 6 directions, 3 time/direction
Thermal shock	3	-40°C to $+100^{\circ}\text{C}$, unit temperature 20 cycles
Thermal cycling	3	-40°C to $+55^{\circ}\text{C}$, temperature change rate: $1^{\circ}\text{C}/\text{min}$, cycles: 2 cycles
Humidity	3	40°C , 95%RH, 48h
Solder ability	15	IPC J-STD-002C-2007

Characteristic Curves

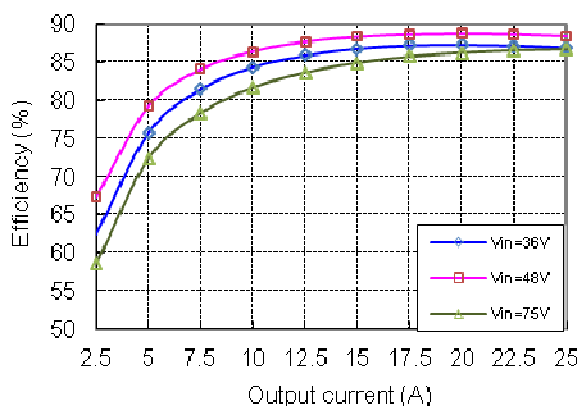


Figure 1 Efficiency vs. output current, $T_a = 25^{\circ}\text{C}$, $V_o = 3.3\text{V}$

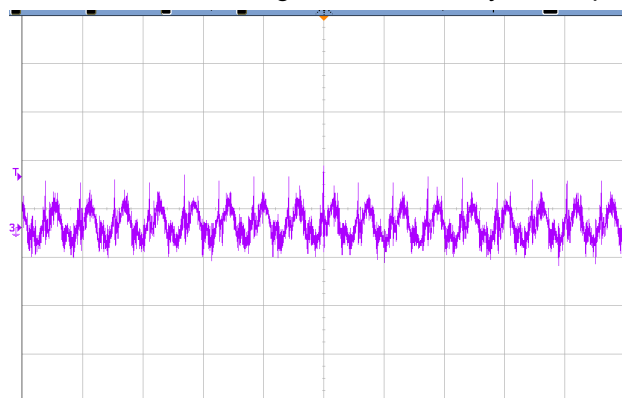


Figure 2 Output ripple & noise (5 $\mu\text{s}/\text{div}$, 10mV/div), see Figure 17 for test configuration

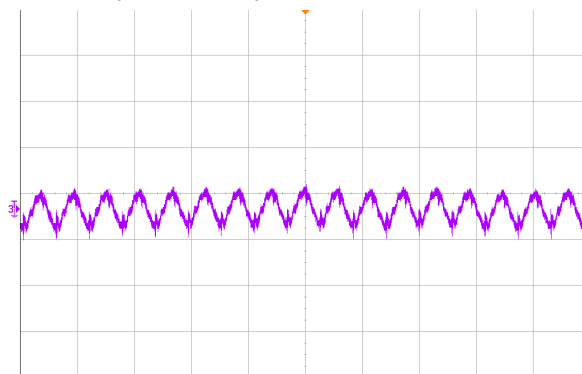


Figure 3 Input reflected ripple current (5 $\mu\text{s}/\text{div}$, 5mA/div), see Figure 17 for test configuration

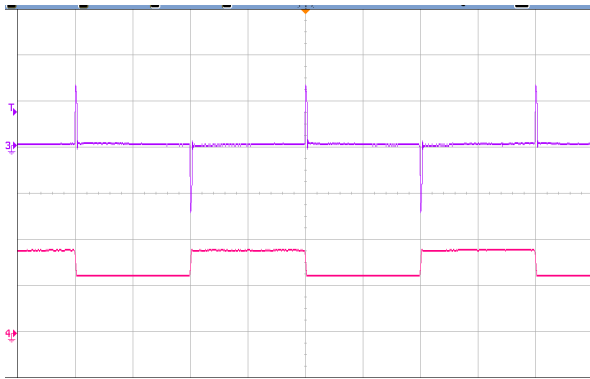


Figure 4 Dynamic response for 25% load step (50% ~ 75% ~ 50%) and 0.1A/ μ s slew rate, (2ms/div), see Figure 12 for test configuration; CH3-output voltage (50mV/div); CH4-output current (10A/div)

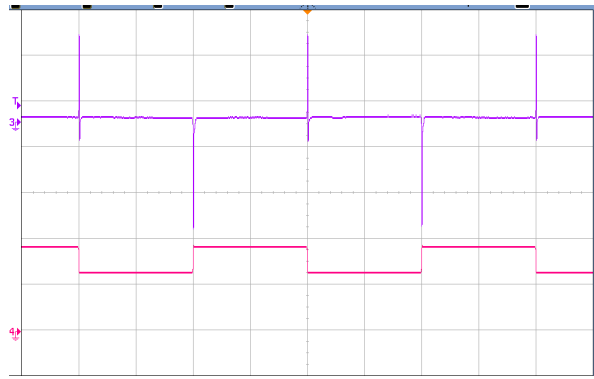


Figure 5 Dynamic response for 25% load step (50% ~ 75% ~ 50%) and 1A/ μ s slew rate, (2ms/div), see Figure 12 for test configuration; CH3-output voltage (100mV/div); CH2-output current (10A/div)

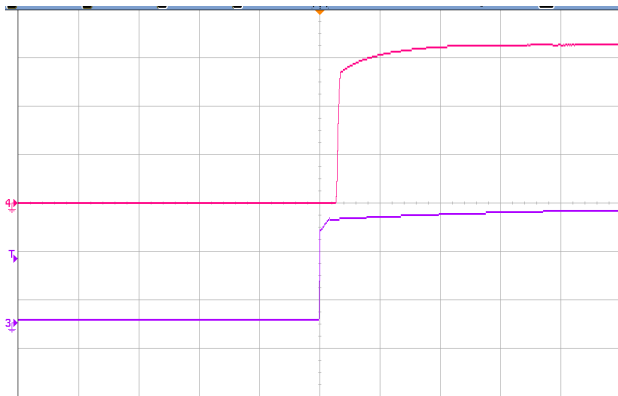


Figure 6 Output voltage startup by power on, (5ms/div), see Figure 12 for test configuration; CH4-output voltage (1V/div); CH3-input voltage (20V/div)

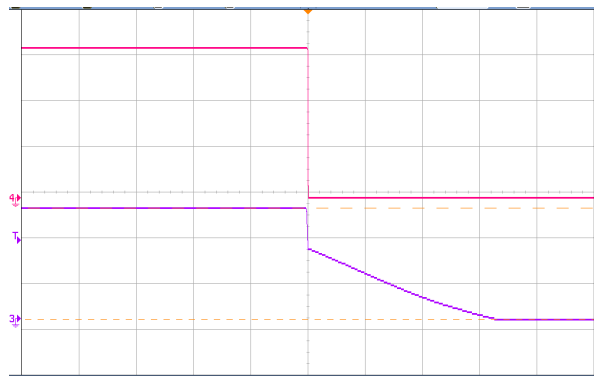


Figure 7 Output voltage shutdown by power off, (100 ms/div), see Figure 12 for test configuration; CH4-output voltage (1V/div); CH3-input voltage (20V/div)

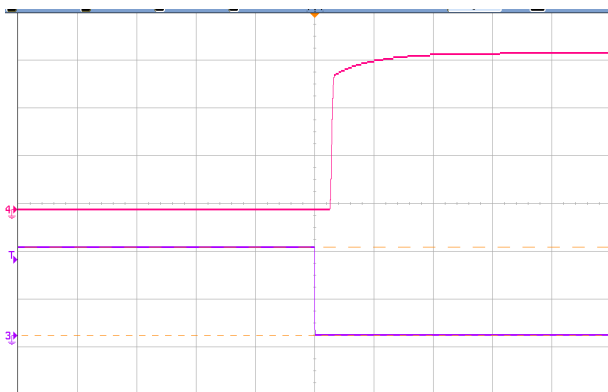


Figure 8 Output voltage startup by remote ON, (5ms/div), see Figure 12 for test configuration; CH4-output voltage (1V/div); CH3-remote ON voltage (2V/div)

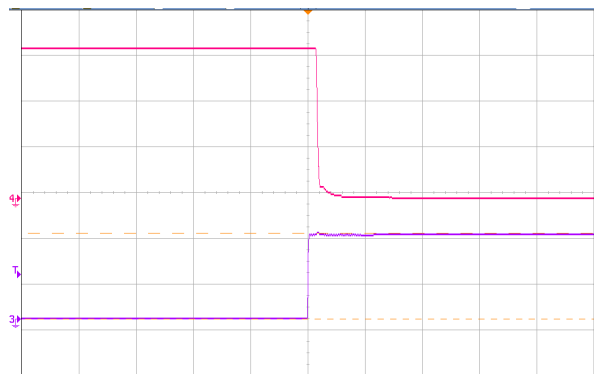


Figure 9 Output voltage shutdown by remote OFF, (500 μ s/div), see Figure 12 for test configuration; CH4-output voltage (1V/div); CH3-remote OFF voltage (2V/div)

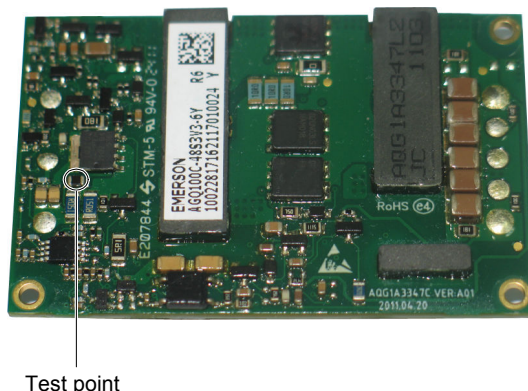


Figure 11 OTP test point

Application Note

Typical Application

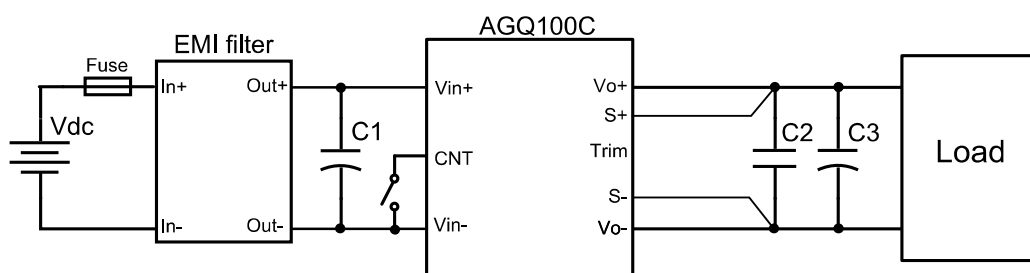


Figure 12 Typical application

C1: Recommended input capacitor, 100uF/100V high frequency low ESR electrolytic type capacitor.
 C2: Recommended 1uF/25V ceramic capacitor. P/N: C3225X7R2A105KT0L0U (TDK) or equivalent caps.

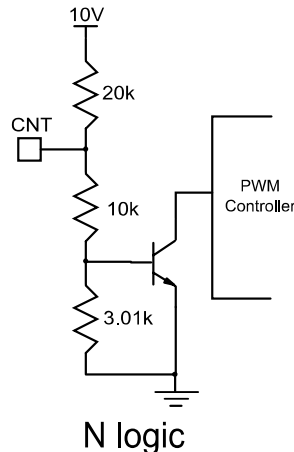
C3: Recommended output capacitor, 1,000uF/25V high frequency low ESR electrolytic type capacitor. P/N: UPM1E102MHD (Nichicon) or equivalent caps.

Fuse: External fast blow fuse with a rating of 5A. The recommended fuse model is 216005.P from LITTLEFUSE.

Remote ON/OFF

Negative remote ON/OFF logic is available in AGQ100C-48S3V3-6Y. The logic is CMOS and TTL compatible.

Below is the detailed internal circuit and reference in AGQ100C-48S3V3-6Y.



N logic

Figure 13 Remote ON/OFF internal diagram

The voltage between pin Remote ON/OFF and pin V_{in-} must not exceed the range listed in *Feature Characteristics* to ensure proper operation. The external remote ON/OFF circuit is highly recommended as shown in Figure 14.

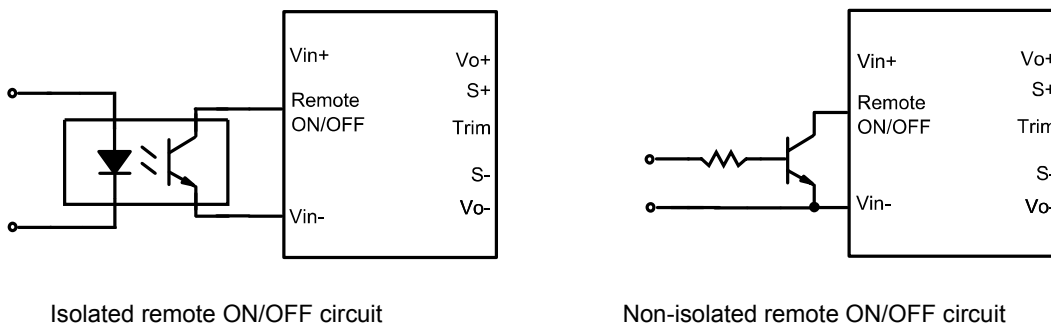


Figure 14 External remote ON/OFF circuit

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.

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

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

Note: $\Delta = \left| \frac{V_o - V_{nom}}{V_{nom}} \right|$

V_{nom} : Nominal output voltage.

For example, to get 3.63V output, the trimming resistor is

$$\Delta = (3.63 - 3.3) \times 100 / 3.3 = 10$$

$$R_{adj-up} = \frac{5.1 \times 3.3 \times (100 + 10)}{1.225 \times 10} - \frac{510}{10} - 10.2 = 89.9k\Omega$$

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

$$V_{trim} = [1 + 1.988\Delta] \times 1.225$$

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 and the minimum input voltage should be increased as shown in below figures.

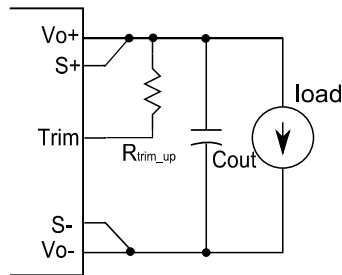


Figure 15 Trim up

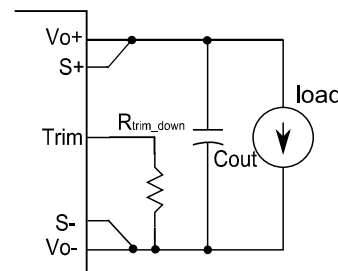


Figure 16 Trim down

Sense Characteristics

If the load is far from the unit, connect S+ and S- to the terminals of the load respectively to compensate the voltage drop on the transmission line. See Figure 12.

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

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

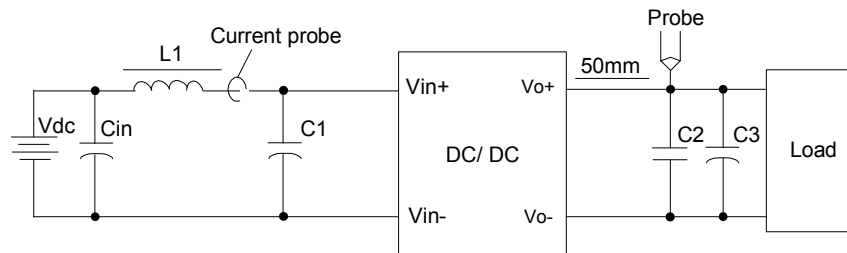


Figure 17 Input ripple & inrush current, ripple & noise test configuration

Vdc: DC power supply

L1: 12μH@100KHz

Cin: 100μF/100V typical

C1 ~ C3: See Figure 12

Note: It is recommended to use a coaxial cable with series 50Ω resistor and 0.68μF ceramic capacitor or a ground ring of probe to test output ripple & noise.

EMC Test Conditions

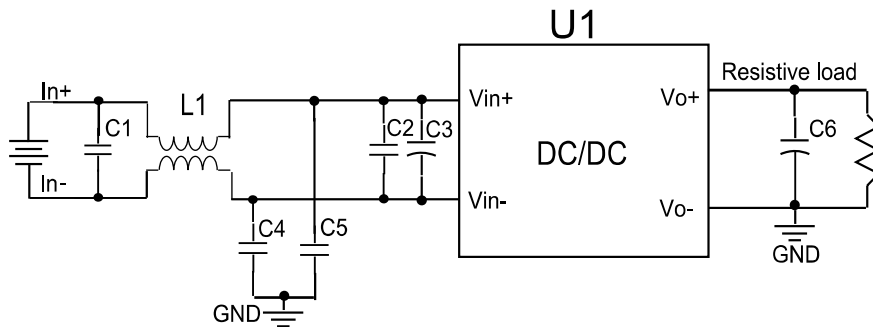


Figure 18 EMC test configuration

U1: Module to test, AGQ100C-48S3V3B-6Y

C1: Recommended SMD ceramic capacitor -100V-1000nF-X7R-1210

C2: SMD ceramic capacitor-100V-100nF-±10%-X7R-1206

C3: Input electrolytic capacitor, according to the same type as C1 in Figure 12

C4, C5: Recommended high-voltage chip ceramic capacitor. Capacitance: 0.022uF/250V, capable of withstanding 1kV voltage

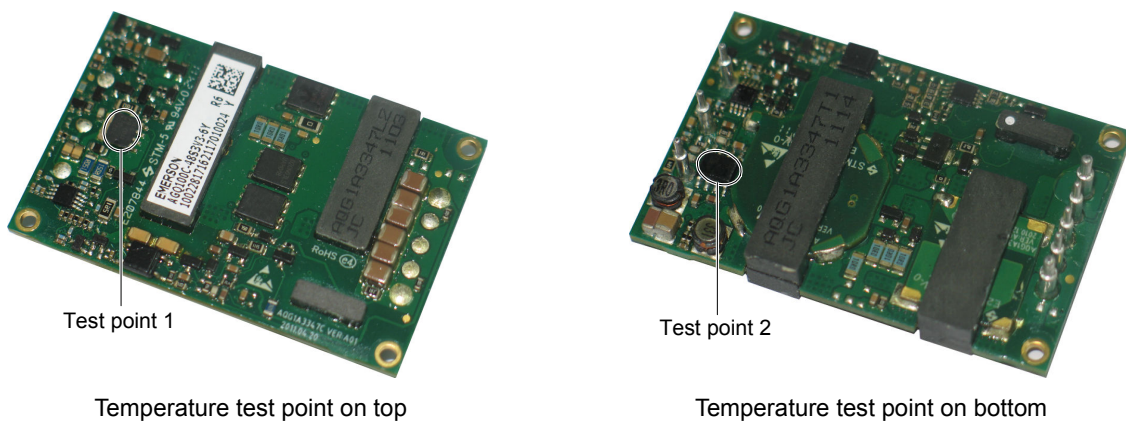
C6: Output electrolytic capacitor, according to the same type as C3 in Figure 12

L1: Common mode inductor-single phase-1320uH-±25%-4A-R5K-21*21*12.5mm

V_{o-} and baseplate: Be connected to PE

Thermal Considerations

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 Figure 19. The temperature at these points should not exceed the maximum values in the Table 1.



Temperature test point on top

Temperature test point on bottom

Figure 19 Temperature test points

Table 1 Temperature limit of the test points

Test point	Temperature limit
Test point 1	130°C
Test point 2	122°C

For a typical application, Figure 21 shows the derating of output current vs. ambient air temperature at different air velocity. Figure 20 shows the typical test condition.

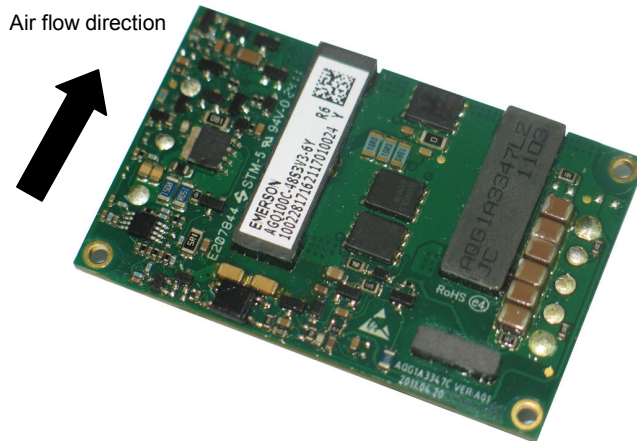


Figure 20 Typical test condition

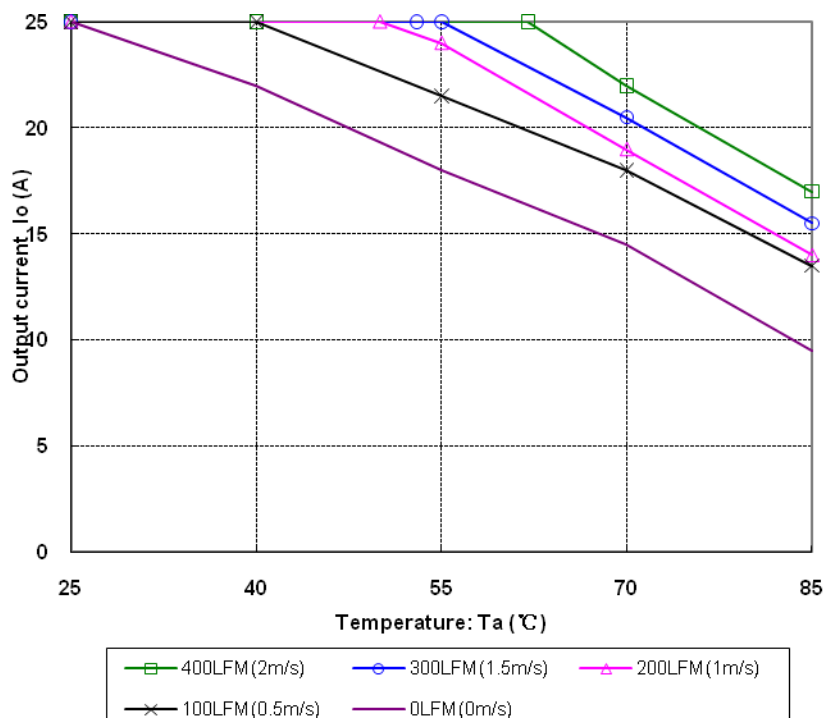
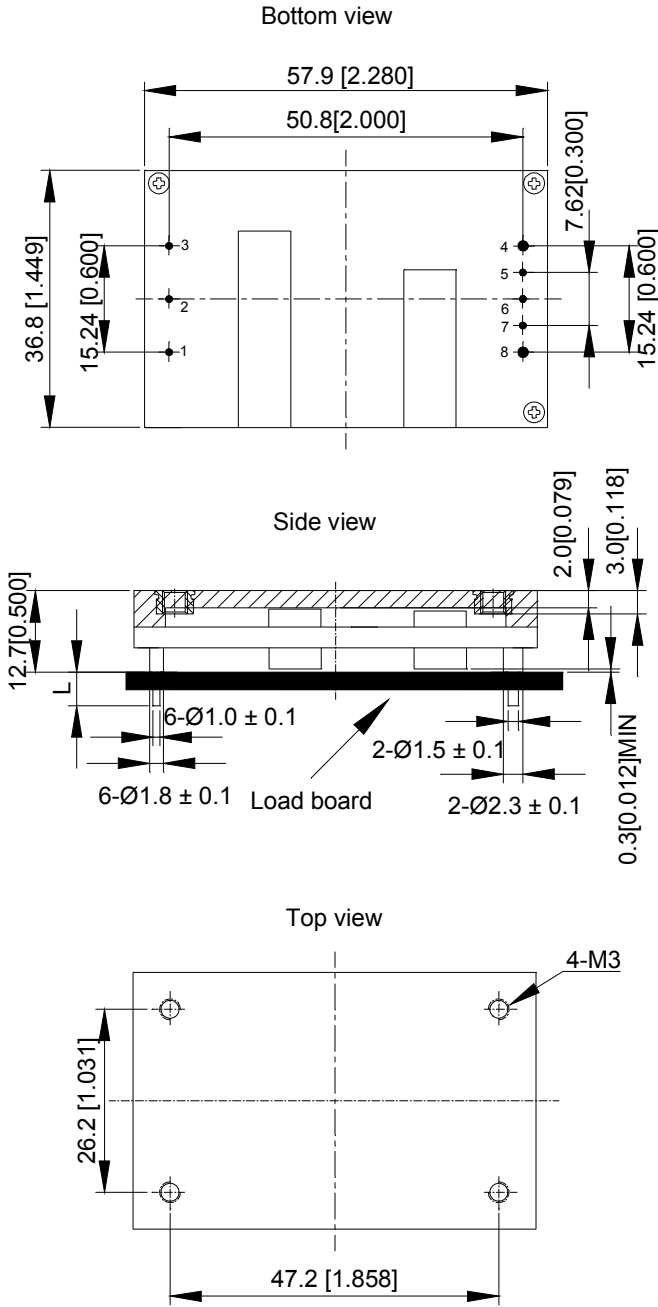


Figure 21 Output power derating, 48V_{in}, air flowing across the converter from pin 3 to pin 1

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 22 Mechanical diagram

Pin Length Option

Device code suffix	L
-4	4.8mm ± 0.5mm
-6	3.8mm ± 0.25mm
-8	2.8mm ± 0.25mm
None	5.8mm ± 0.5mm

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 the solder joint can be performed with cleaning solvent IPA or simulative.

Assembly:

The maximum length of the screw driven into heatsink is 3.3mm.

Ordering Information

AGQ100C	-	48	S	3V3			-	6	Y
①		②	③	④	⑤	⑥		⑦	⑧

①	Model series	AGQ: high efficiency quarter-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	3V3: 3.3V output
⑤	Remote ON/OFF logic	Default: negative; P: positive logic
⑥	Structure option	Default: open frame; B: with baseplate
⑦	Pin length	-6: 3.8mm ± 0.25mm
⑧	RoHS status	L: RoHS, R6; Y: RoHS, R5

Model number	Description
AGQ100C-48S3V3-6Y	3.8mm pin length; negative ON/OFF logic; without thread inside mounting hole; R5 compliant; for detailed information, refer to <i>AGQ100C-48S3V3-6Y Technical Reference Notes</i>

Hazardous Substances Announcement (RoHS Of China)

Parts	Hazardous substances					
	Pb	Hg	Cd	Cr ⁶⁺	PBB	PBDE
AGQ100C-48S3V3-6Y	√	x	x	x	x	x
<p>x: 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"> 1. Solders (including high-temperature solder in parts) contain plumbum. 2. Glass of electric parts contains plumbum. 3. Copper alloy of pins contains plumbum 						