

ADQ700-48S12-4L

696 Watts

Quarter-brick Converter

Total Power: 696 Watts
Input Voltage: 40 to 60 Vdc
of Outputs: Single



Special Features

- Delivering up to 58A output
- Ultra-high efficiency 96.0% typ. at 50% load
- Startup Pre-bias: 0%Vout ~ 95%Vout
- Input range: 40V ~ 60V
- Excellent thermal performance
- No minimum load requirement
- RoHS2.0(2011/65/EU)
- Remote control function
- PMBus Rev.1.2 Compliance
- Input under voltage lockout
- Input over voltage lockout
- Output over current protection
- Output over voltage protection
- Over temperature protection
- Industry standard quarter-brick pin-out outline
- Open-frame and baseplated
- Pin length option: 4.6mm

Safety

IEC/EN/UL/CSA 62368
CE Mark
UL/TUV
Materials meet UL94, V-0
EN55022 ClassB

Product Descriptions

The ADQ700-48S12-4L is a single output DC-DC converter with standard quarter-brick outline and pin configuration. It delivers up to 58A output current with 12V output voltage. Ultra-high 96.0% efficiency and excellent thermal performance makes it an ideal choice for use in datacom and telecommunication applications and can work under $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$ with air cooling.

Applications

Telecom/ Datacom

Model Numbers

Standard	Output Voltage	Structure	Remote ON/OFF logic	RoHS Status
ADQ700-48S12-4L	12Vdc	Open-frame	Negative	RoHS2.0(2011/65/EU)
ADQ700-48S12B-4L	12Vdc	Baseplated	Negative	RoHS2.0(2011/65/EU)
ADQ700-48S12-4LI	12Vdc	Open-frame	Negative	RoHS2.0(2011/65/EU)
ADQ700-48S12B-4LI	12Vdc	Baseplated	Negative	RoHS2.0(2011/65/EU)

Ordering information

ADQ700	-	48	S	12	P	B	-	4	L	I
①		②	③	④	⑤	⑥		⑦	⑧	⑨

①	Model series	ADQ: high efficiency quarter brick series, 700: output power 696W
②	Input voltage	48: 40V ~ 60V input range, rated input voltage 48V
③	Output number	S: single output
④	Rated output voltage	12: 12V output
⑤	Remote ON/OFF logic	Default: negative logic; P: positive logic
⑥	Baseplate	B: with baseplate; default: open frame
⑦	Pin length	4: 4.6mm ± 0.25mm pin length
⑧	RoHS status	Y: Rohs, R5; L: RoHS, R6
⑨	PMBus	I: With PMBus communication; Default: Without PMBus communication

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	$V_{IN,DC}$	- -	- -	64 80	Vdc Vdc
Maximum Output Power	All	$P_{O,max}$	-	-	696	W
Isolation Voltage ¹ Input to output	All		-	-	1500	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	-	12	Vdc
Humidity (non-condensing) Operating	All		-	-	95	%

Note: 1 - 1mA for 60s,slew rate of 500V/1S.

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions ¹	Symbol	Min	Typ	Max	Unit	
Operating Input Voltage, DC	All	$V_{IN,DC}$	40	48	60	Vdc	
Input under-voltage lockout	Turn-on Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,ON}$	36	38.7	40	Vdc
	Turn-off Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,OFF}$	35	37	39	Vdc
	Lockout Voltage Hysteresis	$I_O = I_{O,max}$		1	-	3	Vdc
Input over voltage lockout	Turn-on Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,ON}$	60.5	62.3	64.5	Vdc
	Turn-off Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,OFF}$	62.5	64.5	66.5	Vdc
	Lockout Voltage Hysteresis	$I_O = I_{O,max}$		1	-	3	Vdc
Maximum Input Current ($I_O = I_{O,max}$)	$V_{IN,DC} = 40Vdc$	$I_{IN,max}$	-	-	20.5	A	
No Load Input Current	$V_{IN,DC} = 48Vdc$	I_{IN}	-	150	-	mA	
Standby Input Current	Remote Off	I_{IN}	-	10	100	mA	
Recommended Input Fuse	Fast blow external fuse recommended		-	-	30	A	
Recommended External Input Capacitance	Low ESR capacitor recommended	C_{IN}	220	-	-	uF	
Input Ripple Current	Through 12uH inductor		-	200	-	mA	
Input Filter Component Value(C\L)	Internal values		-	14.1\0.2 2	-	μF\μH	
Operating Efficiency	$T_A = 25\text{ }^{\circ}C$ $I_O = I_{O,max}$ $I_O = 50\%I_{O,max}$	η	-	96.0	-	%	
			-	96.0	-	%	

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

Output Specifications

Table 3. Output Specifications:

Parameter	Condition ¹	Symbol	Min	Typ	Max	Unit	
Factory Set Voltage	$V_{IN,DC} = 48Vdc$ $I_O = I_{O,max}$	V_O	11.88	12.00	12.12	Vdc	
Output Voltage Line Regulation	All	$\pm V_O$	-	20	60	mV	
Output Voltage Load Regulation	All	$\pm V_O$	-	20	60	mV	
Output Voltage Temperature Regulation	All	$\%V_O$	-	0.002	0.02	$\%/^{\circ}C$	
Output Ripple, pk-pk	Measure with a 0.68uF output capacitor to 20MHz bandwidth	V_O	-	200	-	mV_{PK-PK}	
Output Current	All	I_O	0	-	58	A	
Output DC current-limit inception ²		I_O	64	-	82	A	
V_O Load Capacitance	All	C_O	220	-	5000 ³	uF	
V_O Dynamic Response	Peak Deviation Settling Time	50%~75%~50% $I_{O,max}$ slew rate = 0.1A/us	$\pm V_O$	-	200	-	mV
		T_s	-	200	-	uSec	
		50%~75%~50% $I_{O,max}$ slew rate = 1A/us	$\pm V_O$	-	350	-	mV
			T_s	-	200	-	uSec
Turn-on transient	Rise time	$I_O = I_{O,max}$	T_{rise}	-	15	100	mS
	Turn-on delay time	$I_O = I_{O,max}$	$T_{turn-on}$	-	50	100	mS
	Turn-On overshoot	$I_O = 0$			0		$\%V_O$
Switching frequency	All	f_{SW}		200		KHZ	
Remote ON/OFF control (positive logic)	Off-state voltage			-0.3		1.2	Vdc
	On-state voltage			3.5		12	Vdc
Remote ON/OFF control (negative logic)	Off-state voltage			3.5		12	Vdc
	On-state voltage			-0.3		1.2	Vdc
Output over-voltage protection ⁴	All		13.8	-	16	Vdc	
Pre-bias		$\%V_O$	0	-	95	%	
Output over-temperature protection ⁵	All	T	-	120	-	$^{\circ}C$	
Over-temperature hysteresis	All	T	5	-	-	$^{\circ}C$	

Output Specifications

Table 3. Output Specifications, con't:

Parameter	Condition	Symbol	Min	Typ	Max	Unit
MTBF	Telcordia SR-332 Method 1 Case 1 Rated Output@80% load 300LFM, 40 °C T _A		-	1.5	-	10 ⁶ h

Note 1 - T_A = 25 °C, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise noted.

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

Note 3 - The output capacitance is OSCON or similar type.

Note 4 - Hiccup: auto-restart when over-voltage condition is removed

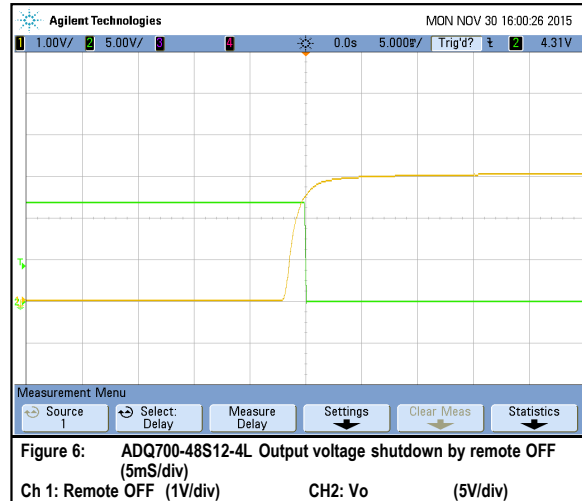
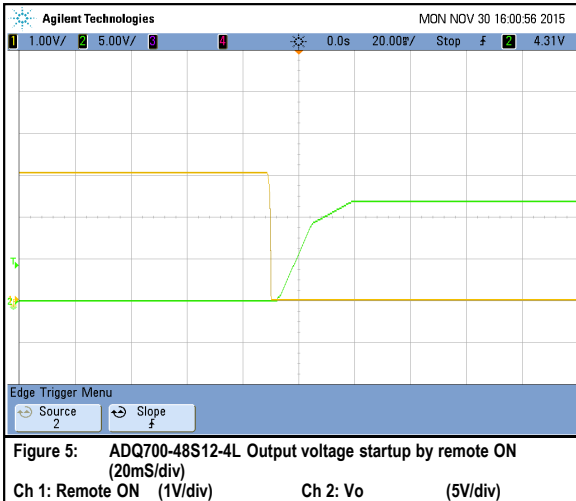
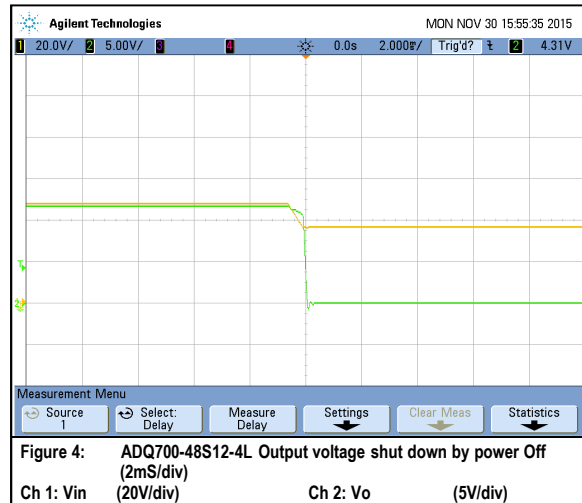
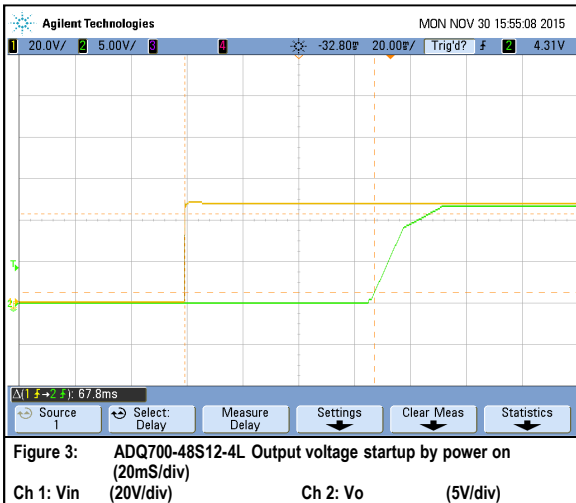
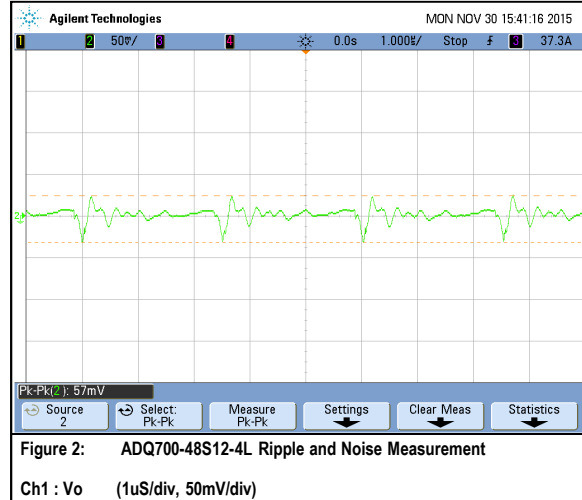
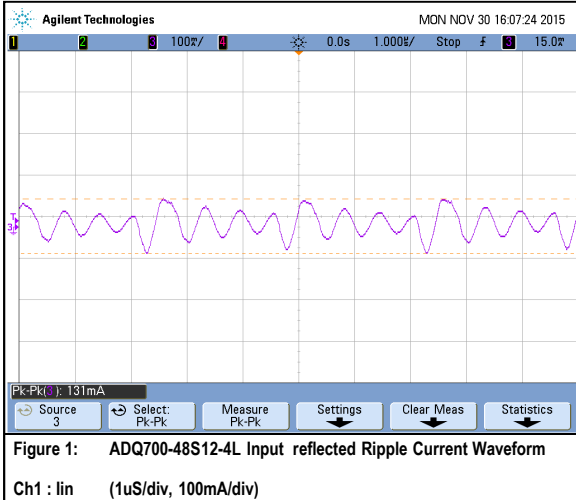
Note 5 - Auto recovery when over-temperature condition is removed

PMBus™ signal interface characteristics

Table 4. PMbus signal interface characteristics:

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Input High Voltage (CLK,DATA)			2.1	-	3.6	V
Input Low Voltage (CLK,DATA)			0	-	0.4	V
Input High Level Current (CLK,DATA)			-10	-	10	uA
Output Low Voltage (CLK,DATA)	I _O =2mA		-	-	0.4	V
Output high level open drain Leakage (CLK,DATA)	V _O = 3.3V		-	5	-	uA
PMBUS operation frequency				100		KHz

ADQ700-48S12-4L Performance Curves



ADQ700-48S12-4L Performance Curves

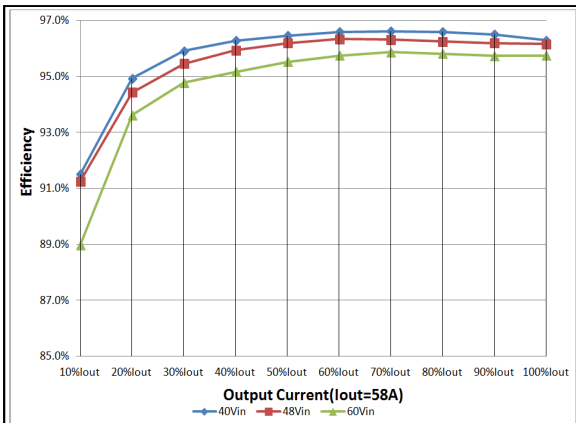
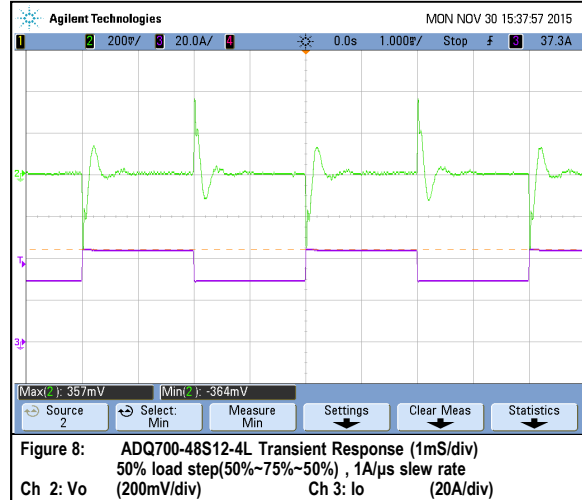
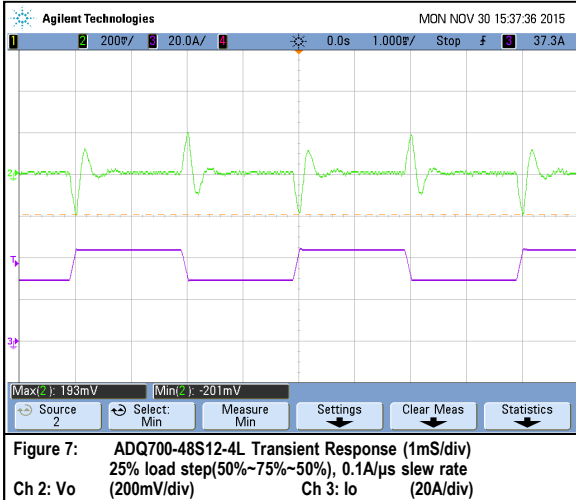
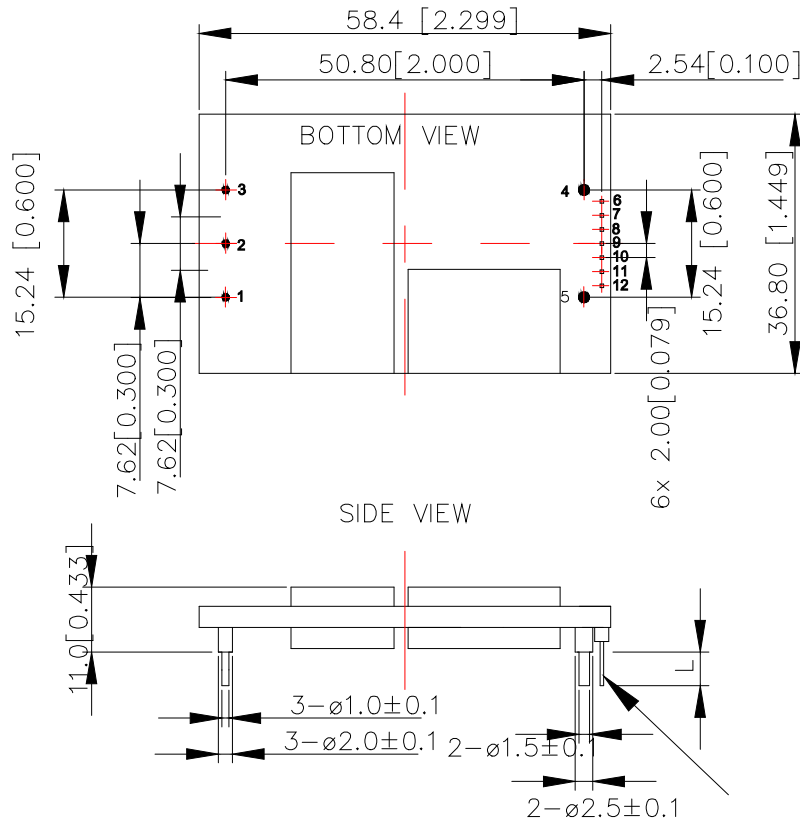


Figure 9: ADQ700-48S12-4L Efficiency Curves @ 25 °C

Loading: Io = 10% increment to 58A

Mechanical Specifications

Mechanical Outlines- Open Frame Module



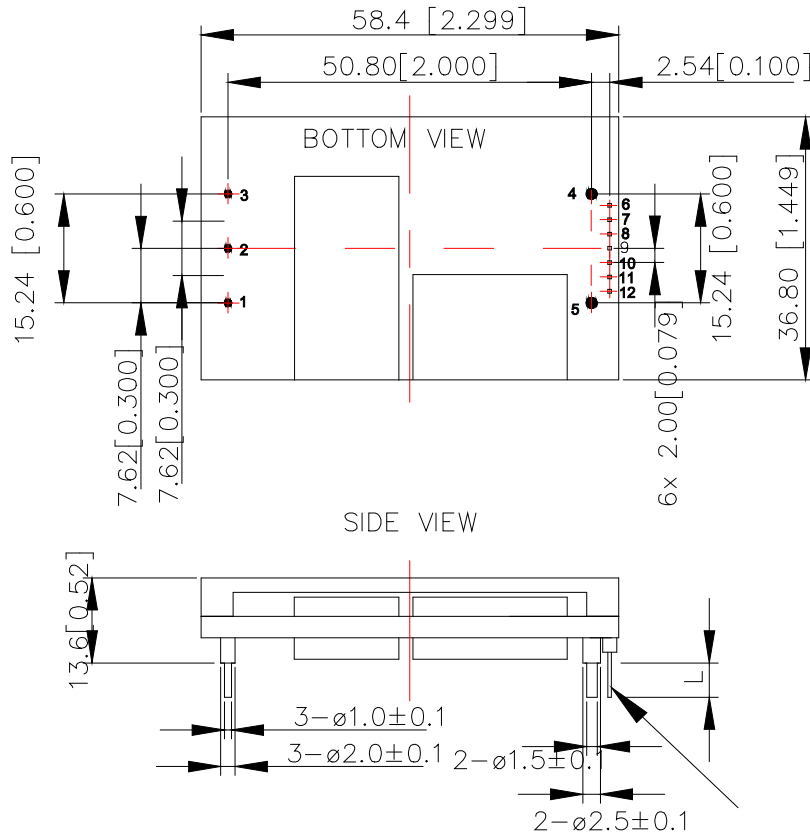
UNIT: mm[inch]

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

X.XXmm±0.25mm[X.XXX in.±0.01in.]

Notes: 1. Dimensions within the box are critical dimensions.

Mechanical Outlines- Baseplate Module



UNIT: mm[inch] BOTTOM VIEW: pin on upside L=4.60mm
 TOLERANCE: X.Xmm±0.5mm[X.XX in.±0.02in.]
 X.XXmm±0.25mm[X.XXX in.±0.01in.]

Notes: 1. Dimensions whitin the box are critical dimensions.

Pin Length option

Device code suffix	L
-4	4.6±0.25 mm
-6	3.8±0.25 mm
-8	2.8±0.25 mm
None	5.8±0.25 mm

Pin Designations

Pin No	Name	Function
1	Vin+	Positive input voltage
2	Remote On/Off	Remote control
3	Vin-	Negative input voltage
4	Vo-	Negative output voltage
5	Vo+	Positive output voltage
6	C2	Digital
7	Sig_Gnd	Digital
8	Data	Digital
9	SMBAlert	Digital
10	Clock	Digital
11	Addr1	Digital
12	Addr0	Digital

Environmental Specifications

EMC Immunity

ADQ700-48S12-4L power supply is designed to meet the following EMC immunity specifications:

Table 4. Environmental Specifications:

Document	Description	Criteria
EN55022, Class B Limits	Conducted and Radiated EMI Limits, DC input port	B
IEC/EN 61000-4-2, Level 3	Electromagnetic Compatibility (EMC) - Testing and measurement techniques: Electrostatic discharge immunity test	B
IEC/EN 61000-4-4, Level3	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 port	B
IEC/EN 61000-4-6, Level 2	Electromagnetic Compatibility (EMC) - Testing and measurement techniques: Continuous Conducted Interference. DC input port	A
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.

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.

Recommend EMC Filter Configuration

See figure 20

Safety Certifications

The ADQ700-48S12-4L 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 ADQ700-48S12-4L power supply system

Document	File #	Description
UL/CSA 62368		US and Canada Requirements
EN 62368		European Requirements
IEC 62368		International Requirements
CE		CE Marking

Operating Temperature

The ADQ700-48S12-4L 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 85 °C.

Thermal Considerations – Open-frame module(ADQ700-48S12-4L)

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 point as shown in the Figure 10. The temperature at this point should not exceed the max values in the table 6.

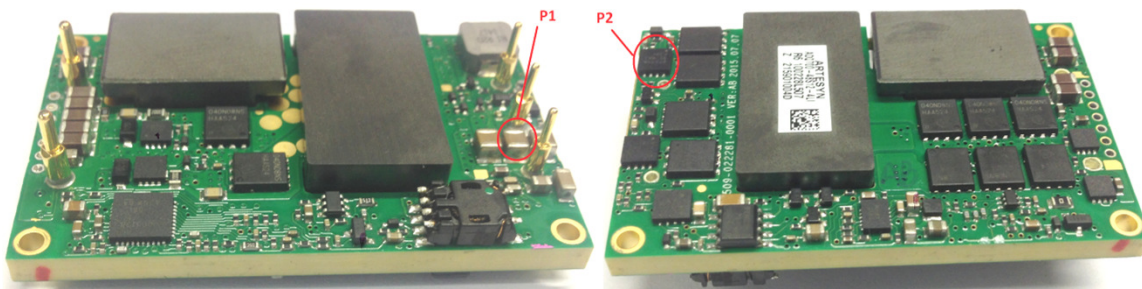


Figure 10 Temperature test point

Table 6. Temperature limit of the test point

Test Point	Temperature Limit
P1	115 °C
P2	120 °C

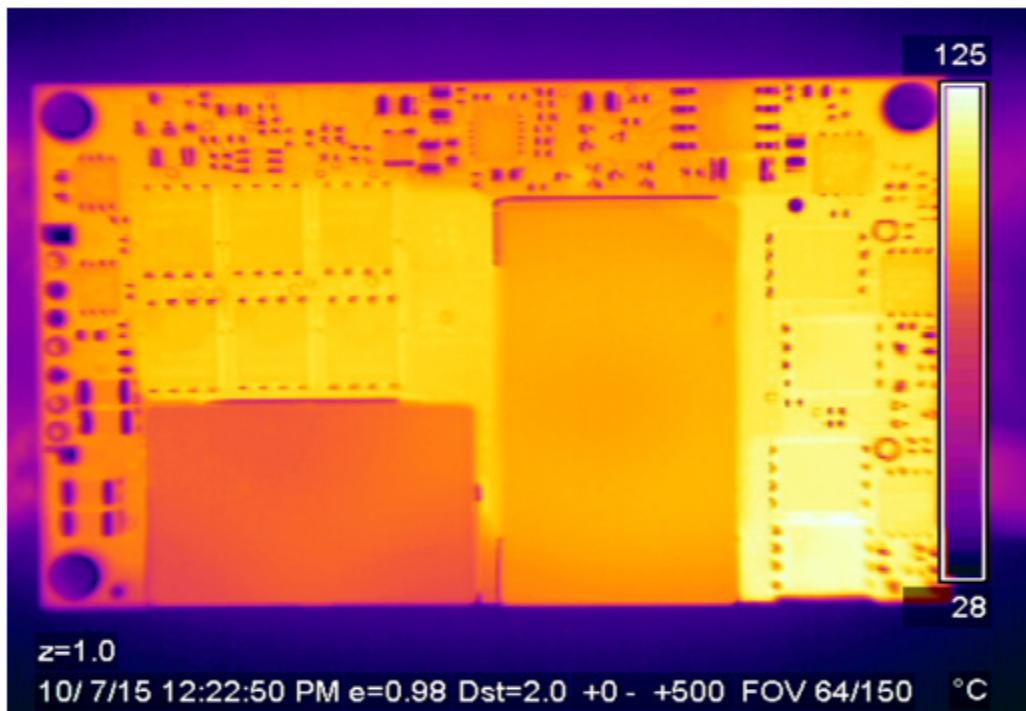


Figure 11 Thermal image, test at 56V_{in}, 12Vo, full load, room temperature

Open-frame unit Thermal De-rating data

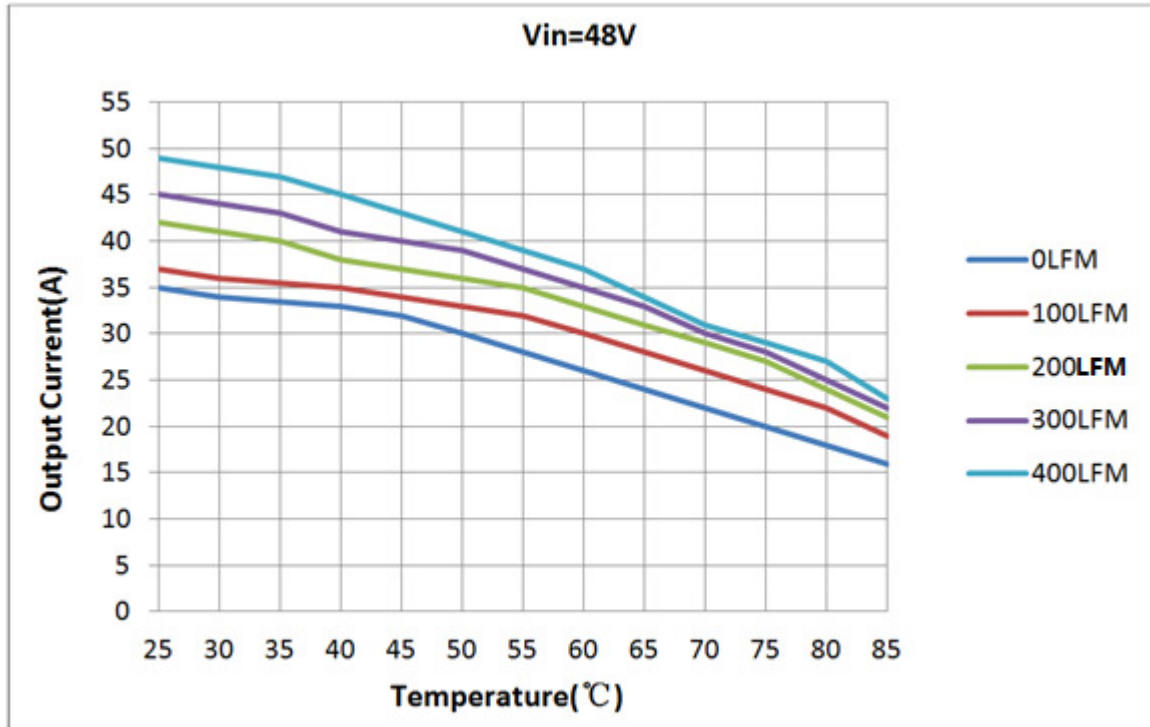


Figure 12 Output power derating, 48V_{in}, air flowing across the converter from Vin- to Vin+

Thermal Considerations – Baseplate module(ADQ700-48S12B-4L)

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 point as shown in the Figure 13. The temperature at this point should not exceed the max values in the table 7.

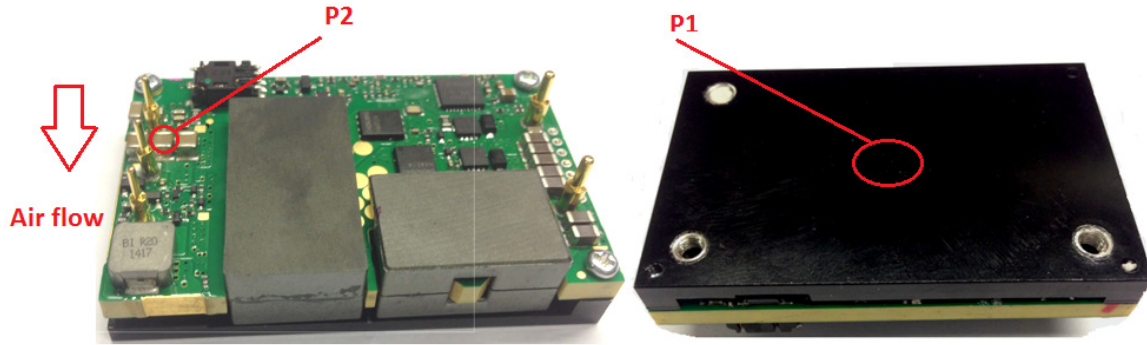


Figure 13 Temperature test point

Table 7. Temperature limit of the test point

Test Point	Temperature Limit
P1	110 °C
P2	115 °C

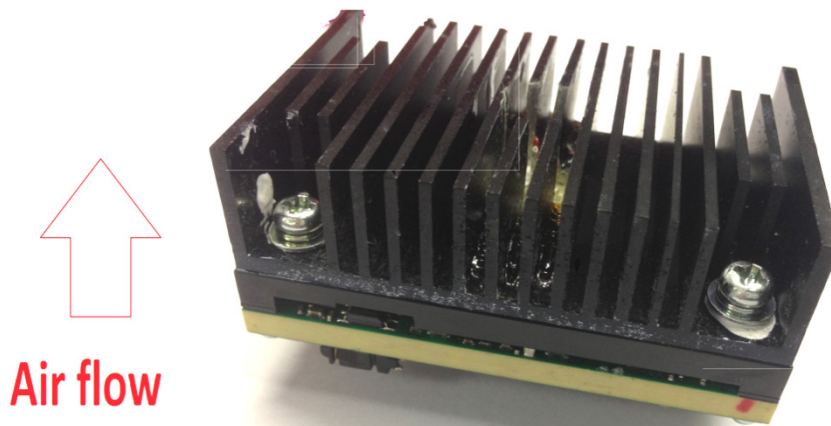


Figure 14 Typical test condition, heatsink

Thermal Considerations – Baseplate module(ADQ700-48S12B-4L)

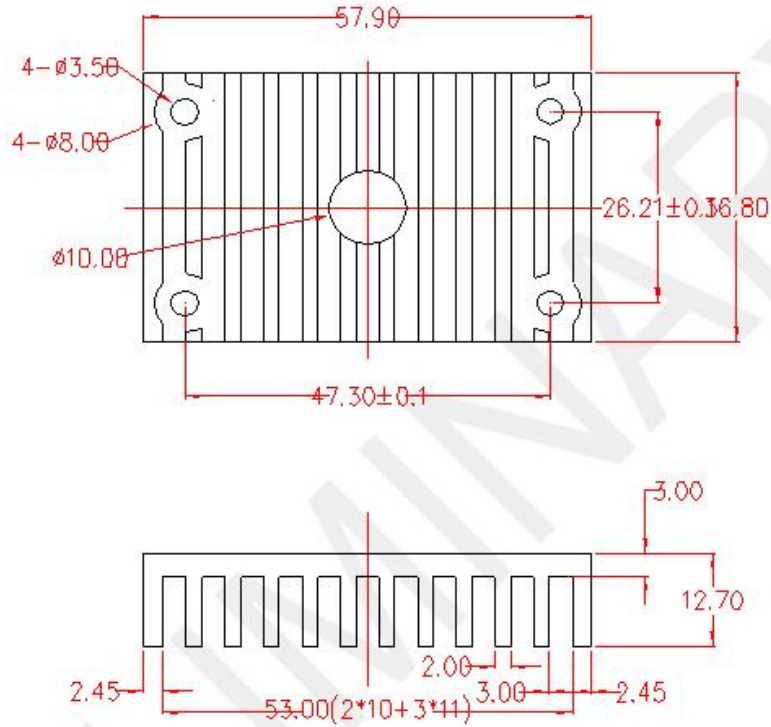


Figure 15 Typical test condition, Heatsink

Baseplate with heatsink unit Thermal De-rating data

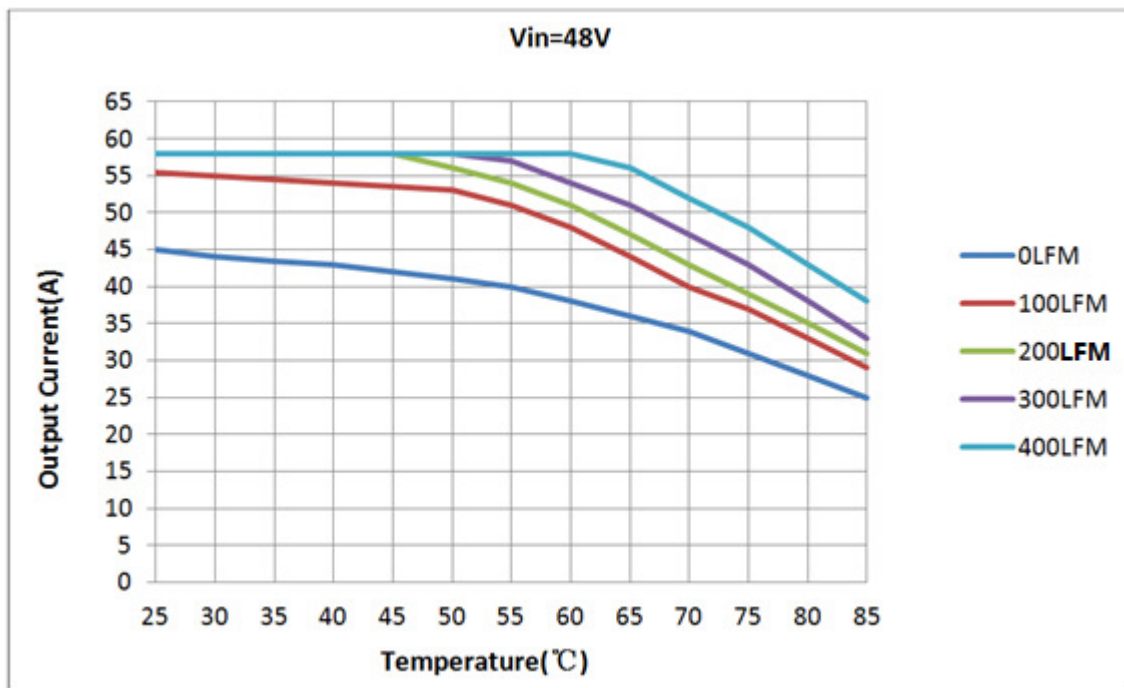


Figure 16 Output power derating, 48V_{in}, air flowing across the converter from Vin- to Vin+

Qualification Testing

Parameter	Unit (pcs)	Test condition
Halt test	4~5	Ta,min-10 °C to Ta,max+30 °C, 5 °C step, Vin = min to max, 0 ~ 100% load
Vibration	3	Frequency range: 5Hz ~ 20Hz, 20Hz ~ 200Hz ASD: 1.0m ² /s ³ , -3db/oct axes of vibration: X/Y/Z; Time: 30min/axis
Mechanical shock	3	30g, 6ms, 3 axes, 6directions, 3times/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 ADQ700-48S12-4L power supply.

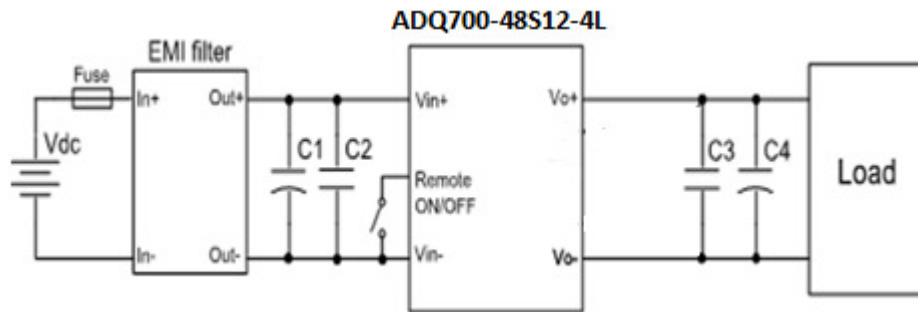


Figure 17 Typical application

C1: 220 μ F/100V electrolytic capacitor, P/N: UPM2A221MPD (Nichicon) or equivalent caps

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

C4: 220 μ F/25V Oscon capacitor, P/N: 16SEPC220M (OS-CON) or equivalent caps

Note: If ambient temperature is below -5 $^{\circ}$ C, double output capacitor (Low ESR, ESR \leq 100m Ω) is needed for output.

Fuse: External fast blow fuse with a rating of 30A/250Vac. The recommended fuse model is 0314030 MRP from Karwin Tech limited.

EMI filter: refer to Figure 20

Remote ON/OFF

Either positive or negative remote ON/OFF logic is available in ADQ700-48S12-4L. The logic is CMOS and TTL compatible. Below is the detailed internal circuit and reference in ADQ700-48S12-4L.

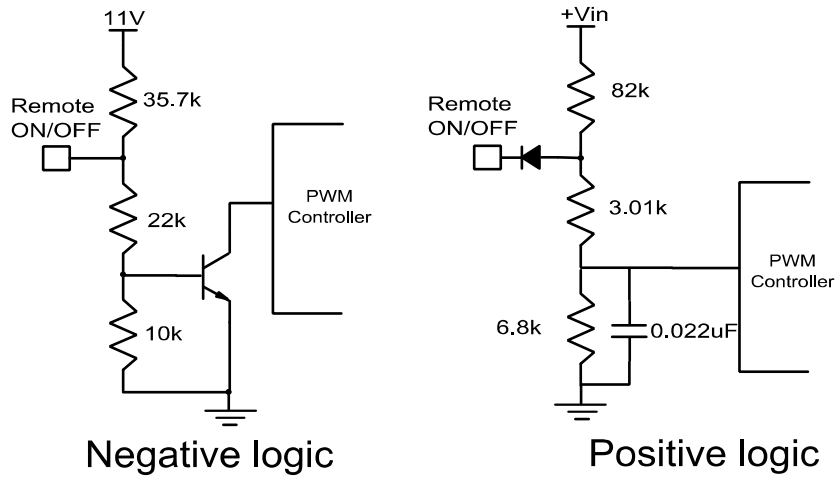


Figure 18 Remote ON/OFF internal diagram

Input Ripple & Output Ripple & Noise Test Configuration

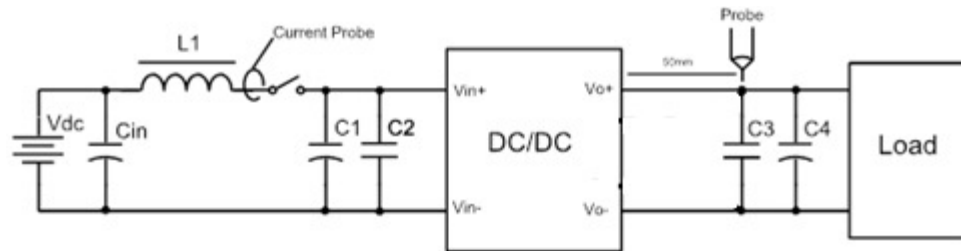


Figure 19 Input ripple & inrush current & ripple and noise test configuration

Vdc: DC power supply
L1:12uH
Cin: 220uF/100V typical
C1~C4: See Figure 17

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.

EMC Test Conditions

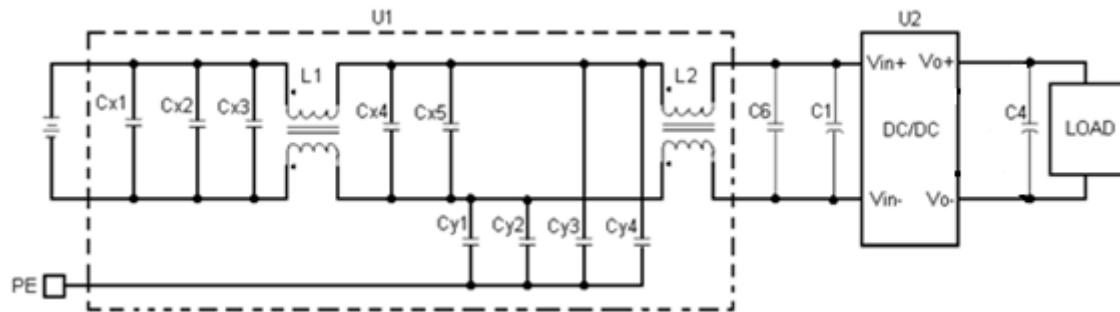


Figure 20 EMC test conditions

U1: Input EMC filter

U2: Module to test, ADQ700-48S12-4L

CX1, CX2, CX4, CX5: 1 μ F/100V/X7R capacitor

CX3: 2200nF/100V/X7S capacitor

Cy1, Cy2, Cy3, Cy4: 0.47 μ F/250V/X7R, Y capacitor

L1, L2: 473 μ H, common mode inductor.

C6: 100nF/100V/X7R capacitor

C1, C4: See Figure 17

PMBus Communication

PMBus Communication

The module has a digital PMBus interface to allow the module to be monitored, controlled and configured by the system. The module supports 3 PMBus signal lines, Data, Clock, Control (C2 pin, optional), and 2 Address line Addr0 and Addr1. More detail PMBus information can be found in the PMBus Power Management Protocol Specification, Part I and part II, revision 1.2; which is shown in <http://pmbus.org>. 100kHz bus speed is supported by the module.

The module supports the Packet Error Checking (PEC) protocol. It can check the PEC byte provided by the PMBus master, and include a PEC byte in all message responses to the master.

The module contains a data flash used to store configuration settings, which will not be programmed into the device data flash automatically. The STORE_DEFAULT_ALL command must be used to commit the current settings are transfer from RAM to data flash as device defaults.

PMBus Addressing

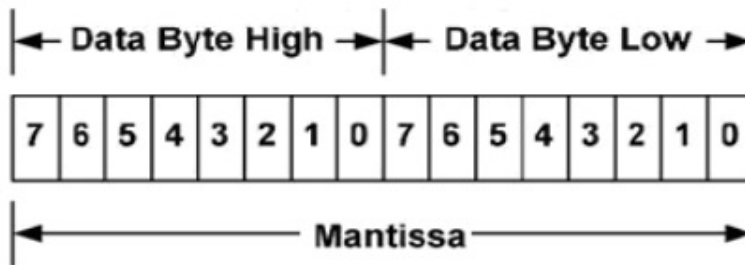
The module has fixed PMBUS address (0x59). Through this address, the host computer can address the module.

PMBus Data Format

The module receives and report date in LINEAR format. The Exponent of the data words is fixed at a reasonable value for the command; altering the exponent is not supported.

DIRECT format is not supported by the module.

For commands that set or report any voltage thresholds related to the output voltage, the module supports the linear data format consisting of a two byte value with a 16-bit, unsigned mantissa, and a fixed exponent of -12. The format of the two data bytes is shown below:



The equation can be written as:

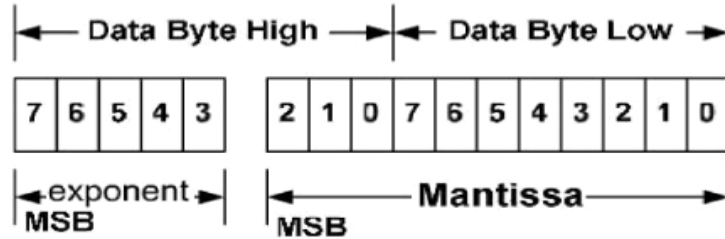
$$V_{out} = \text{Mantissa} \times 2^{-9}$$

For example, considering set V_{out} to 12V by $V_{OUT_COMMAND}$, the read/write data can be calculated refer to below process:

1. $\text{Mantissa} = V_{out} / 2^{-9} = 12 / 2^{-9} = 6144$;
2. Converter the calculated Mantissa to hexadecimal 0x1800.

For commands that set or report all other thresholds, including input voltages, output current, temperature, time and frequency, the supported linear data format is a two byte value with: an 11 bit, two's complement mantissa , and a 5 bit, two's complement exponent (scaling factor).The format of the two data bytes is shown as in below.

PMBus Data Format



The equation can be written as:

$$\text{Value} = \text{Mantissa} \times 2^{\text{exponent}}$$

For example, considering set the turn on threshold of input under voltage lockout to 33V by VIN_ON command; the read/write data can be calculated refer to below process:

1. Get the exponent of Vin, 0; whose binary is 00000
2. Mantissa = $V_{in}/2^0 = 33/2^0 = 33$;
3. Converter the calculated Mantissa to hexadecimal 21, then converter to binary 00000100001;
4. Combine the exponent and the mantissa, 00000 and 0000000000100001;
5. Converter binary 0000000000100001 to hexadecimal 0021.

The detail exponent and resolution of main parameter is to be decided later.

ADQ700-48S12-4L Supported PMBus Command List

The main PMBus commands described in the PMBus 1.2 specification are supported by the module. Partial PMBus commands are fully supported; Partial PMBus commands have difference with the definition in PMBus 1.2 specification. The details about all the supported PMBus commands are to be decided later.

ADQ700-48S12-4L_PMBus command list:

Command	Command Code	Command description	Transf	Compatible with standard PMBUS or not?	Data Format	Default value	Range limit	Data units	Exponent	Note
OPERATION	0x01	Turn the module on or off by PMBUS command	R/W	Refer to below description	Bit field	0x80	/	/	/	/
ON_OFF_CONFIG	0x02	Configures the combination of primary on/off pin and PMBUS command	R/W	Refer to below description	Bit field	0x1D (Neg Logic); 0x1F (Pos Logic);	/	/	/	/
CLEAR_FAULTS	0x03	Clear any fault bits that have been set	Send	Yes	/	/	/	/	/	/
STORE_DEFAULT_ALL	0x11	Stores operating parameters from RAM to data flash	Send	Yes	/	/	/	/	/	This command is effective to the parameter of all command in the table.
RESTORE_DEFAULT_ALL	0x12	Restores operating parameters from data flash to RAM	Send	Yes	/	/	/	/	/	This command can't be issued when the power unit is running.
VOUT_MODE	0x20	To read Vo data format	Read	Yes	mode+exp	0x17	/	/	/	/
VOUT_COMMAND	0x21	Set the output voltage	R/W	Yes	Vout Linear	12	9.6~13.2	Volts	-9	/
FREQUENCY_SWITCH	0x33	Set the switching frequency	R/W	Yes	Frequency Linear	200	190~210	KHz	0	/
VIN_ON	0x35	Set the turn on voltage threshold of Vin under voltage lockout	R/W	Yes	Vin Linear	39	36~46	V	0	VIN_ON should be higher than VIN_OFF, and keep 2V hystersis.
VIN_OFF	0x36	Set the turn off voltage threshold of Vin under voltage lockout	R/W	Yes	Vin Linear	37	34~46	V	0	VIN_ON should be higher than VIN_OFF, and keep 2V hystersis.

Supported PMBus Command List:

Command	Command Code	Command description	Transf	Compatible with standard PMBUS or not?	Data Format	Default value	Range limit	Data units	Exponent	Note
VOUT_OV_FAULT_LIMIT	0x40	Set the output overvoltage fault threshold.	R/W	Yes	Vout Linear	14.4	11~16	V	-9	Must be higher than the value of VOUT_COMMAND and VOUT_OV_WARN_LIMIT;
VOUT_OV_FAULT_RESPONSE	0x41	Instructs what action to take in response to an output overvoltage fault.	Read	Refer to below description	Bit field	0xB8	/	N/A	/	/
VOUT_OV_WARN_LIMIT	0x42	Set a threshold causing an output voltage high warning.	R/W	Yes	Vout Linear	14.5	11~16	V	-9	Must be less than VOUT_OV_FAULT_LIMIT value
OT_FAULT_LIMIT	0x4F	Set the over temperature fault threshold.	R/W	Yes	TEMP Linear	118	25~140	Deg.C		Must be greater than OT_WARN_LIMIT value
OT_FAULT_RESPONSE	0x50	Instructs what action to take in response to an over temperature fault.	Read	Refer to below description	Bit field	0x80	/	N/A	/	/
OT_WARN_LIMIT	0x51	Set a threshold causing a temperature high warning.	R/W	Yes	TEMP Linear	115	25~125	Deg.C	0	Must be less than OT_FAULT_LIMIT value
VIN_OV_FAULT_LIMIT	0x55	Set the input overvoltage fault threshold.	R/W	Yes	Vin Linear	65	48~70	V	0	/
VIN_OV_FAULT_RESPONSE	0x56	Instructs what action to take in response to an over Vin fault.	Read	Refer to below description	Bit field	0xC0	/	N/A	/	/
POWER_GOOD_ON	0x5E	Sets the output voltage at which the bit 3 of STATUS_WORD high byte should be asserted.	R/W	Yes	Vout Linear	11	8.1~13.2	V	-9	Must be greater than POWER_GOOD_OFF value by 1.6V
POWER_GOOD_OFF	0x5F	Sets the output voltage at which the bit 3 of STATUS_WORD high byte should be negated.	R/W	Yes	Vout Linear	9	8.1~13.2	V	-9	Must be less than POWER_GOOD_ON value by 1.6V
STATUS_WORD	0x79	Returns the information with a summary of the module's fault/warning	Read	Refer to below description	Bit field	/	/	/	/	/
READ_VIN	0x88	Returns the input voltage of the module	Read	Yes	Vin Linear	/	/	Volts	/	/
READ_VOUT	0x8B	Returns the output voltage of the module	Read	Yes	Vout Linear	/	/	Volts	/	/

Supported PMBus Command List:

Command	Command Code	Command description	Transf	Compatible with standard PMBUS or not?	Data Format	Default value	Range limit	Data units	Exponent	Note
READ_TEMPERATURE_1	0x8D	Returns the module's hot spot temperature of the module	Read word	Yes	TEMP Linear	/	/	Deg.C	/	/
PMBUS_REVISION	0x98	Reads the revision of the PMBus	Read byte	Yes	Bit field	1.2	/	/	/	/
MFR_C2_Configure	0xE0	Configures the C2 pin (secondary on/off pin) function and logic;	R/W byte	Refer to below description	Bit field	0x00	/	/	/	/
MFR_PGOOD_POLARITY	0xE1	Configure Power Good logic	R/W byte	Refer to below description;	Bit field	0x00	/	/	/	/
MFR_C1_C2_ARA_CONFIGURATION	0xF7	Configure C2 pin function	R/W byte	Refer to below description	Bit field	0x00	/	/	/	/
MFR_SERIAL	0x9E	Reads the SN of module	Read block		Total 5 ASCII characters	'xxxxx'	/	/	/	The SN number of module use 5 ASCII characters

Supported PMBus Command

OPERATION [0x01]

Bit number	Purpose	Bit Value	Meaning	Default Settings, 0x80
7:	Enable/Disable the module	1	Output is enabled	1
		0	Output is disabled	
6:	Reserved			0
5:4	Margins	00	No margin	00
		01	Margin low(Act on Fault)	
		10	Margin high(Act on Fault)	
3:0	Reserved			0000

VOUT_OV_FAULT_RESPONSE [0x41]

Bit number	Purpose	Bit Value	Meaning	Default Settings, 0xB8
7: 6	Response settings	10	Unit shuts down and responds according to the retry settings	10
5:3	Retry setting	111	Unit continuously restarts while fault is present until commanded off	111
		000	Unit does not attempt to restart on fault	
2:0	Delay time setting	000	No delay supported	000

OT_FAULT_RESPONSE [0x50]

Bit number	Purpose	Bit Value	Meaning	Default Settings, 0x80
7: 6	Response settings	10	Unit shuts down and responds according to the retry settings	10
5:3	Retry setting	111	Unit continuously restarts while fault is present until commanded off	000
		000	Unit does not attempt to restart on fault	
2:0	Delay time setting	000	No delay supported	000

VIN_OV_FAULT_RESPONSE [0x56]

Bit number	Purpose	Bit Value	Meaning	Default Settings, 0xC0
7: 6	Response settings	11	Unit shuts down and responds according to the retry settings	11
5:3	Retry setting	111	Unit continuously restarts while fault is present until commanded off	000
		000	Unit does not attempt to restart on fault	
2:0	Delay time setting	000	No delay supported	000

Supported PMBus Command

STATUS_WORD [0x79]

High byte

Bit number	Purpose	Bit Value	Meaning
7	An output over voltage fault	1	Reserved
		0	Reserved
6	An output over current fault or warning	1	Reserved
		0	Reserved
5	An input voltage fault, including over voltage and under-voltage	1	Reserved
		0	Reserved
4	Reserved		
3	Power_Good	1	Reserved
		0	Reserved
2:0	Reserved		

Low byte

Bit number	Purpose	Bit Value	Meaning
7	Reserved		
6	OFF (The unit is not providing power to the output, regardless of the reason)	1	Occurred
		0	No Occurred
5	An output over voltage fault	1	Occurred
		0	No Occurred
4	An output over current fault	1	Occurred
		0	No Occurred
3	An input under voltage fault	1	Occurred
		0	No Occurred
2	A temperature fault or warning	1	Occurred
		0	No Occurred
1	CML (A communications, memory or logic fault)	1	Occurred
		0	No Occurred
0	Reserved		

MFR_C1_C2_ARA_CONFIG [0xF7]

Bit number	Purpose	Bit Value	Meaning
7:4	Reserved	000	Reserved
3:0	PIN Configuration	0000	C2 pin: POWER_GOOD
		0010	C2 pin: ON/OFF (Secondary)

Supported PMBus Command

MFR_C2_Configure [0xE0]

Bit number	Purpose	Bit Value	Meaning
7:2	Reserved	000000	Reserved
1	ON/OFF Configuration	0	Secondary side on/off pin state when mapped to C2 is ignored
		1	AND – Primary and Secondary side on/off
0	PIN Configuration	0	Negative Logic (Low Enable: Input < 0.8V wrt Vout(-))
		1	Positive Logic (High Enable: Input > 2.0V wrt Vout(-))

MFR_PGOOD_POLARITY [0xE1]

Bit number	Purpose	Bit Value	Meaning
7:1	Reserved	0000000	Reserved
0	Power Good Logic	0	Negative PGOOD logic
		1	Positive PGOOD logic

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 10s.

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 simulative.

Hazardous Substances Announcement (RoHS of China)

Parts	Hazardous Substances					
	Pb	Hg	Cd	Cr ⁶⁺	PBB	PBDE
ADQ700-48S12XX-4L	x	x	x	x	x	x

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

√: 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

Artesyn Embedded Technologies 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:

1. Solders (including high-temperature solder in parts) contain plumbum.
2. Glass of electric parts contains plumbum.
3. Copper alloy of pins contains plumbum

Record of Revision and Changes

Issue	Date	Description	Originators
1.0	04.06.2016	First Issue	S. Dong
1.1	10.03.2016	Update Picture	K. Wang
1.2	11.03.2016	Update "baseplate unit" to 'baseplate with heatsink unit" and typo"FLM"	K. Wang
1.3	12.21.2018	1.Update safety 60950 to 62368 2.Pmbus communication	K. Wang
1.4	11.26.2019	Update soldering information	K. Wang
1.5	12.04.2019	Spec update	K. Wang
1.6	07.15.2020	HS product EOL	K. Wang

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