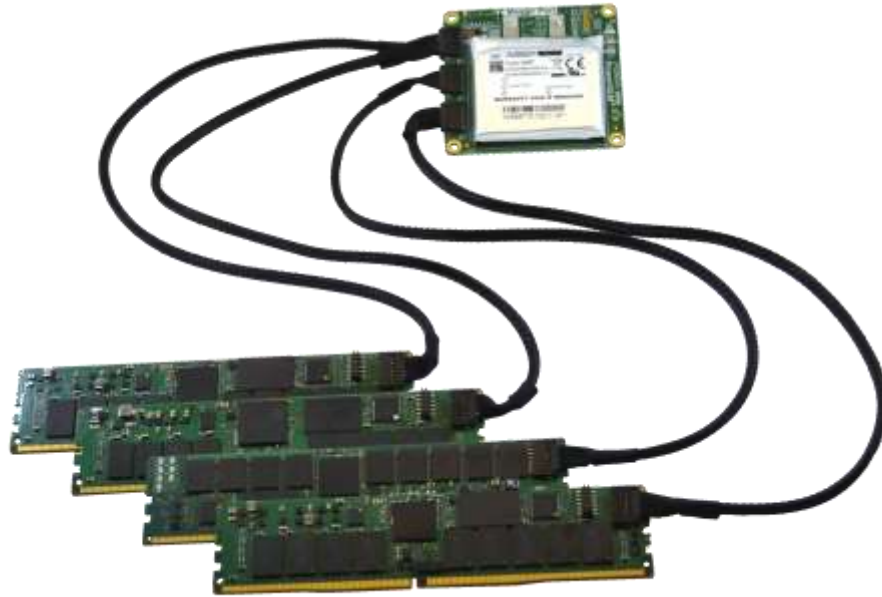

Amber4X/Amber4Xc/ Amber4Xd/Amber4Xe
G-Series
PowerGEM[®] Module
(for use with AGIGARAM[®] DDR4 NVDIMM-N)



AGIGA9834-003JCA/033JCA/103JCA/203JCA

AgigA Tech, Inc. Confidential Information

Copyright © 2021 by AgigA Tech, Inc. All rights reserved.

AgigA Tech, Inc. owns all right, title and interest in the property and products described herein, unless otherwise indicated. No part of this document may be translated to another language or produced or transmitted in any form or by any information storage and retrieval system without written permission from AgigA Tech, Inc.

AGIGA TECH, INC, MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN COMPLIANCE WITH THE APPLICABLE AGIGA TECH SPECIFICATION SHEET FOR THE PRODUCT AT THE TIME OF DELIVERY. IN NO EVENT SHALL AGIGA TECH BE LIABLE FOR ANY INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES AS A RESULT OF THE PRODUCT’S PERFORMANCE OR FAILURE TO MEET ANY ASPECT OF SUCH SPECIFICATION.

AGIGA TECH PRODUCTS ARE NOT DESIGNED OR INTENDED FOR USE IN LIFE SUPPORT APPLIANCES, DEVICES OR SYSTEMS WHERE A MALFUNCTION OF AN AGIGA TECH DEVICE COULD RESULT IN A PERSONAL INJURY OR LOSS OF LIFE. CUSTOMERS USING OR SELLING AGIGA TECH DEVICES FOR USE IN SUCH APPLICATIONS DO SO AT THEIR OWN RISK AND AGREE TO FULLY INDEMNIFY AGIGA TECH FOR ANY DAMAGES RESULTING FROM SUCH IMPROPER USE OR SALE.

Information contained herein is presented only as a guide for the applications of AgigA Tech products. AgigA Tech does not warrant this product to be free of claims of patent infringement by any third party and disclaims any warranty or indemnification against patent infringement. No responsibility is assumed by AgigA Tech for any patent infringement resulting from use of its products by themselves or in combination with any other products. No license is hereby granted by implication or otherwise under any patent or patent rights of AgigA Tech or others.

AgigA Tech, Inc. software and related documentation are available only under the terms of the AgigA Tech Software License Agreement.

Trademarks

AgigA Tech, AGIGARAM and PowerGEM are registered trademarks, and AGIGACAP and AGIGASAFE are trademarks of AgigA Tech, Inc. All other brand names, product names, trademarks, and registered trademarks are the property of their respective owners.

AgigA Tech, Inc. reserves the right to change or modify the information contained herein without notice. It is the customer’s responsibility to ensure receipt of the most recent revision of the document. Contact AgigA Tech or visit our web site at www.agigatech.com.

AgigA Tech, Inc.

An Infineon Technologies Company

12230 World Trade Dr., Suite 200

San Diego CA 92128

E-mail: info@agigatech.com

<http://www.agigatech.com/>

Revision History

Document Control No.	Revision Date	Description of Changes
01	11/12/19	Initial Release
02	03/20/19	Added Note about V_{CAP} voltage when V_{IN} is out of spec
03	09/15/20	Updated logo to IFX version Added Note to Max Charge Time parameter

1. Product Overview

The Amber4X G-Series PowerGEM® family are advanced power modules intended for use with one or more Agiga Tech DDR4 NVDIMM-N modules (or another 3rd party DDR4 NVDIMM module incorporating the Agiga Controller or Universal PowerGEM Protocol). Amber4X/Amber4Xd/Amber4Xe PowerGEMs are configured to with multiple ports to support up to four NVDIMMs. All utilize an ultrathin hybrid supercapacitor enabling a small form factor design while also providing the same long-term reliability as the EDLC Ultracapacitor-based PowerGEM families.

A single 6-pin connector (master port) connects via a cable to a supported DDR4 NVDIMM-N. Three additional 6-pin connectors (shared ports) are available on Amber4X/Amber4Xd/Amber4Xe G-Series which allow support for up to four total DDR4 NVDIMM-Ns. The Amber4X/Amber4Xd/Amber4Xe PowerGEMs takes 12 volts in through the Master and/or the Shared ports (provided over the NVDIMM-N edge connector) and supplies a regulated output voltage to the NVDIMMs during power fail operations. No other external system connections are required.

Amber4Xc PowerGEM supports a Central Power Mode, enabling power delivery back to the host system. In this mode, the host system is responsible for communication and management of the PowerGEM through the SMBus connected on a dedicated 10-pin Central Power port. Power is provided back to the system through this port and can then be routed to multiple DIMM sockets to provide power during the NVDIMM Save operation.

A simple block diagram is shown below depicting both use cases. Additional details can be found in the Universal PowerGEM System Specification.

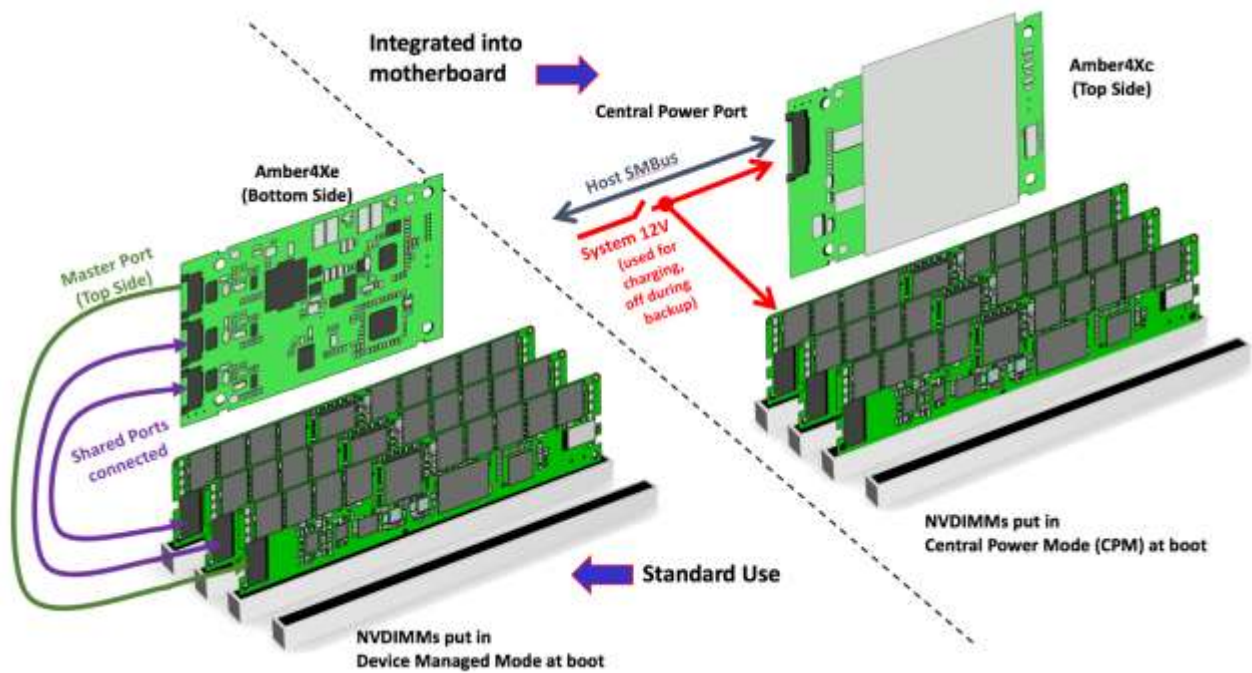


Figure 1. Standard and Central Power Mode

2. System Block Diagram

The Amber4X/Amber4Xd/Amber4Xe G-Series PowerGEM architecture is shown in Figure 2 below.

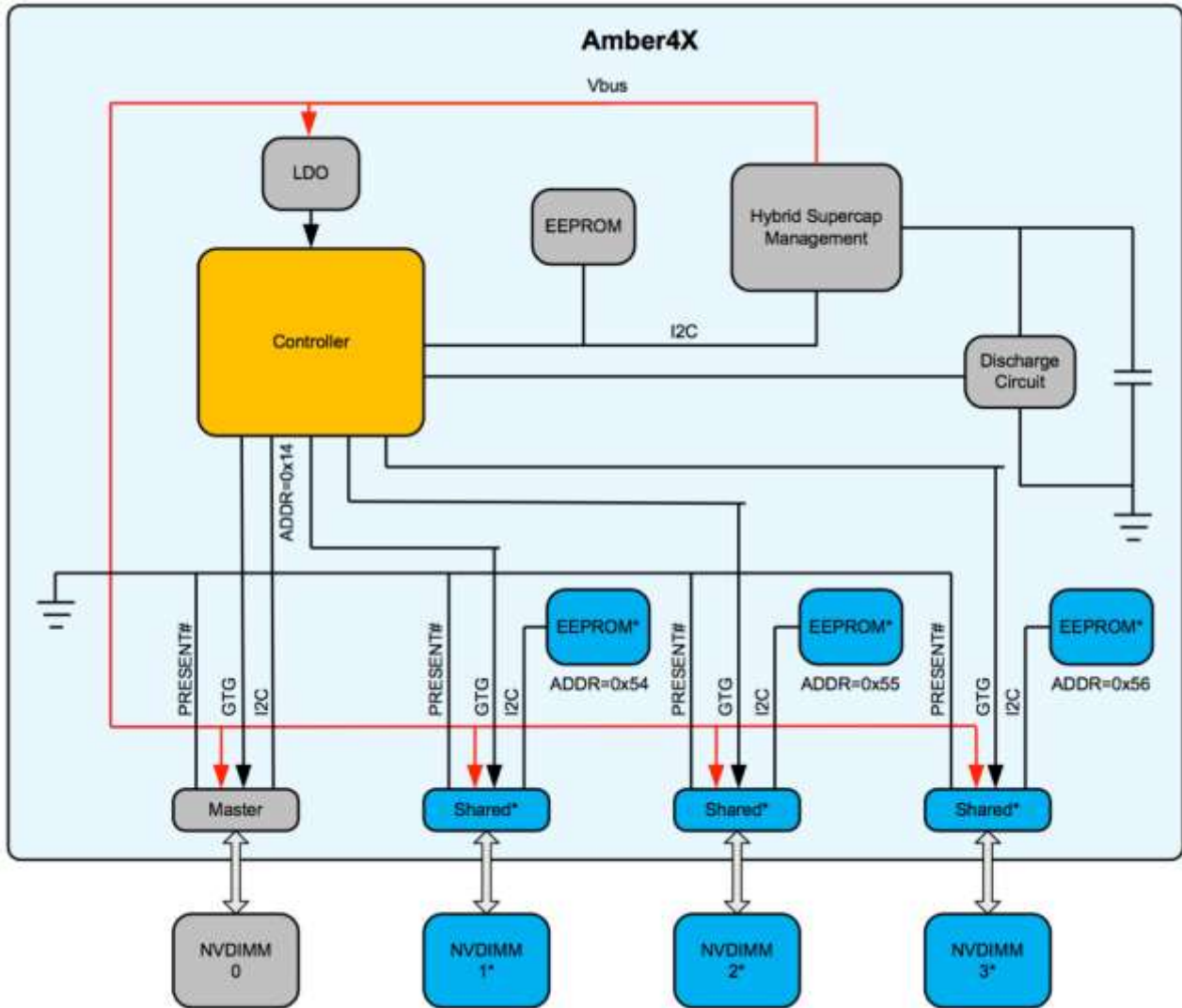


Figure2. Simplified Amber4X/Amber4Xd/Amber4Xe G-Series PowerGEM Diagram

3. Key Features

- Hybrid supercapacitor module
- Cable(s) included
- Provides power to DDR4 NVDIMM-N during SAVE operation in the event of system power loss
- Compatible with AGIGARAM DDR4 NVDIMM-N or other 3rd party DDR4 NVDIMM-Ns using the AgigA Controller or Universal PowerGEM Protocol (please contact AgigA for compatibility requirements)
- Supports up to 4 NVDIMMs (Amber4X/Amber4Xd/Amber4Xe G-Series)
- Multiple form factors available: no bracket, 2.5" drive, HHHL PCIe card
- Real-time health monitoring and logging
- Safe online hybrid supercapacitor measurement (never taken offline during normal operation for state of health or learn cycles)
- Hybrid supercapacitor charged from 12V over DIMM edge connector (no other external connections required)
- Max charge current up to 6A to minimize charge time
- Supports Central Power Mode (Amber4Xc)
- Energy Rating@ 25°C:
1000F Cell – 2600 Joules
- Typical Operating Life: up to 5 years @ 50°C
- Minimum Operating Temp: 10°C
- Product Weight:
AGIGA9834-003JCA - 57g
AGIGA9834-103JCA with case - 128g
AGIGA9834-033JCA - 57g
AGIGA9834-203JCA with bracket – 89g
- RoHS compliant;
- UL/cUL/CB/CE compliant
- Halogen free compliant

*Typical, can be tailored to system requirements

4. Reference Documents

The Amber4X G-Series PowerGEMs are compatible with AGIGARAM DDR4 NVDIMM-Ns or other 3rd party DDR4 NVDIMM-Ns using the AgigA Controller or Universal PowerGEM Protocol. See the relevant Datasheets and Universal PowerGEM System Spec for details.

5. Electrical Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Input Voltage Range ^[1]	V_{IN}	Over input range	10.2	12	13.8	V
Input Supply Current	$I_S(V_{IN})$	$V_{IN} = 12V$	-	-	1	A
OUTPUT CHARACTERISTICS						
Output voltage range	V_{OUT}	$V_{IN} = 0V$. Amber4X/Amber4Xd/Amber4Xe G-Series supply power for NVDIMM backup.	4.75	5.0	5.25	V
		$V_{IN} = 0V$. Amber4Xc provides power for Central Power Mode configuration.	6.75	7.0	7.25	V
Maximum Output Current per port	$I_{OUT-MAX}$	$V_{IN} = 0V$. Amber4X/Amber4Xd/Amber4Xe G-Series supply power for NVDIMM backup.	-	-	1	A
Maximum Output Current per port	$I_{OUT-MAX}$	$V_{IN} = 0V$. Amber4Xc G-Series supply power for Central Power Mode configuration.	-	-	4	A
CAPACITOR/ENERGY CHARACTERISTICS						
Capacitor Voltage	V_{CAP}	$V_{IN} = 12V$: Max V_{CAP} after fully charged state ^[2] $V_{IN} = 0V$: Cap Voltage will drop to 2.5V and then shutoff to protect the cell (FW may shutoff before it drops down to 2.5V if it detects that there is no save operation triggered)	2.5	-	3.7	V
Capacitor Charge Current	I_{CAP}	Charge current is adjusted to meet max Input Supply Current and minimize charge time	-	-	6	A
Initial Effective Capacitance	C_{INIT}	This value is the result of a capacitance measurement commanded over I ² C at time of manufacture at RT.	See specific product below for values			F
End of Life Effective Capacitance	C_{EOL}	This value is 70% of Initial Effective Capacitance at RT.	See specific product below for values			F
End of Life Joules	$J_{EOL-USEABLE}$	Based on CEOL after 5 years at rated temp of 10°C and 25°C	See specific product below for values			J
Charge Time	T_{CHG}	Charge V_{CAP} from 2.5V to 3.6V	See specific product below for values			S

[1] V_{CAP} may exceed max rating if V_{IN} falls to within +50mV of V_{OUT} . This has only been observed in testing and is not an issue under normal operating conditions.

[2] Max V_{CAP} after fully charged state, during health check, the capacitor voltage is raised for a short duration above the nominal operating voltage. This patented feature is to ensure that there is sufficient energy to complete a backup even when a capacitance measurement is in progress.

Product	C_{INIT}	C_{EOL}	$J_{EOL-USEABLE}$ @10°C	$J_{EOL-USEABLE}$ @25°C	Typical T_{CHG}	Max T_{CHG}
AGIGA9834-003JCA/103JCA/ 203JCA/033JCA	1000 F	700 F	1600 J	1800 J	10 minutes	25 minutes

Note: The max charge time occurs under worst case conditions when the cap is fully discharged to 2.5V and the ambient temperature is at the minimum of 10°C. The typical charge time is more common at room temperature.

	MIN	TYP	MAX	Notes
Operating Temperature	10°C	25°C	50°C	
Storage Temperature	-25°C		+65°C	1, 2

[1] After 1000 hours storage, at 65°C without load, the PowerGEM shall meet the specified lifetime requirements. To minimize degradation, AgigA Tech suggests that the PowerGEM modules be stored in a temperature and humidity-controlled environment with the following conditions: - Temperature: 20°C~40°C, Humidity: <RH75%

[2] If storage temp is held at 20°C, it is recommended that the PowerGEM is recharged to the operating voltage after 2 years; If storage temp is held at 40°C or above, it is recommended that the PowerGEM is recharged to the operating voltage after 0.5 years.

6. LED Functional Description

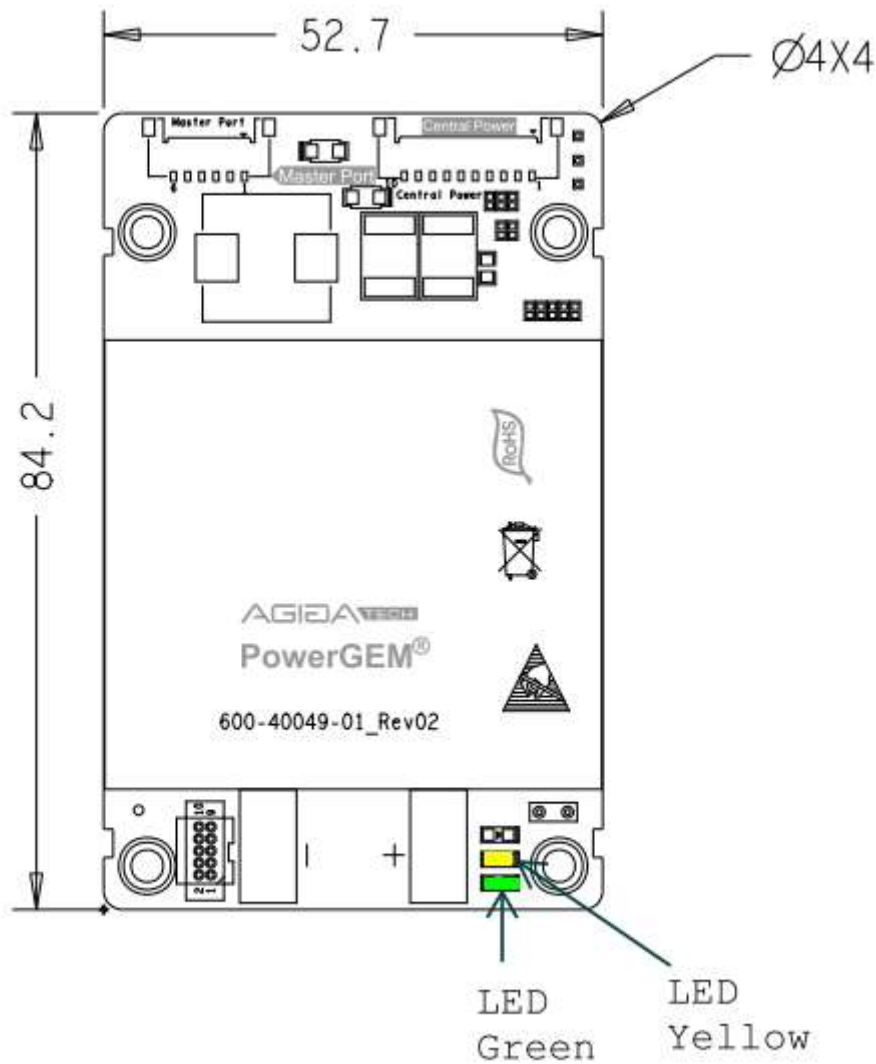


Figure 3. LED Locations

LED	Behavior	Description
LED Green	Quick blinking	Caps are charging
	Slow blinking	Caps are discharging
	On	Caps are fully charged
LED Yellow	On	Indicates Failure

7. Pin Layout

Pinout for the 6-pin Master/Shared Port connector and the 10-pin Central Power connector:

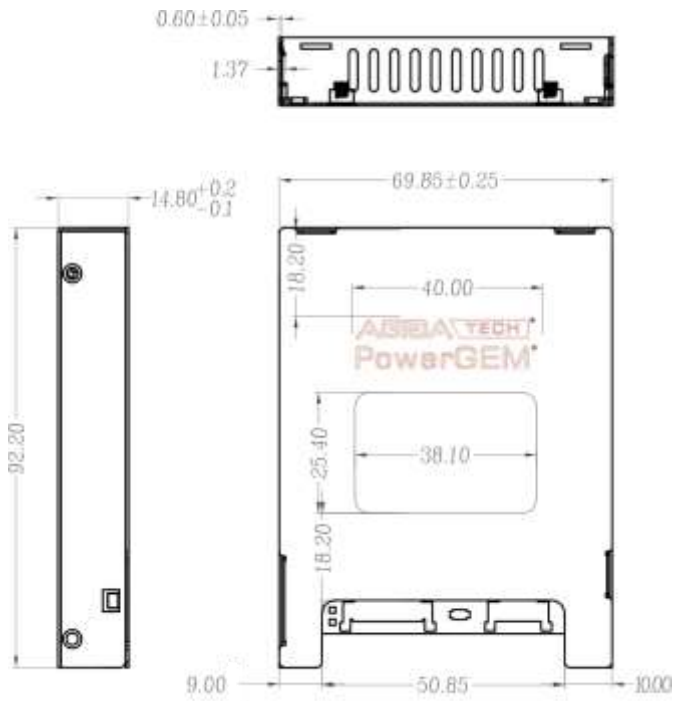
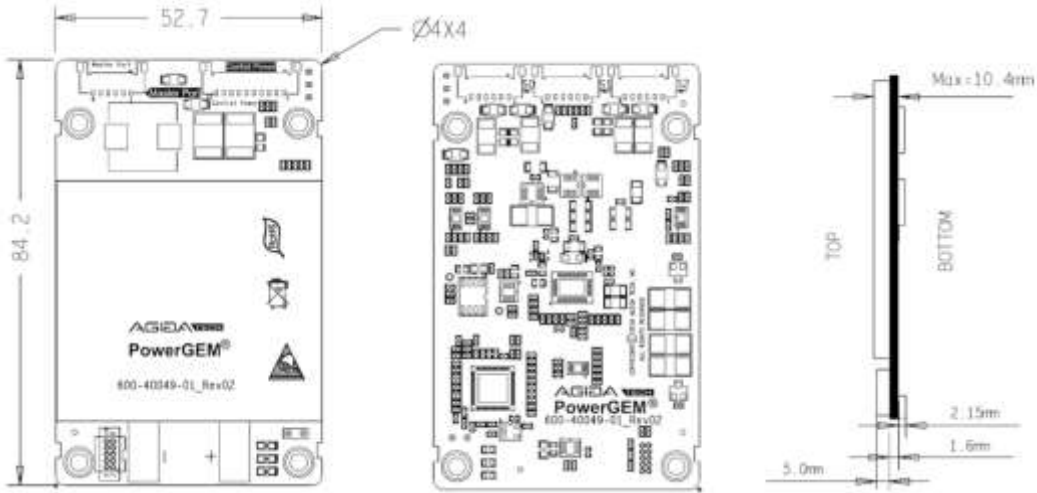
Pin	Signal
1	NVDIMM_IIC_SCL
2	NVDIMM_IIC_SDA
3	PRESENT#
4	GTG
5	GND
6	VBUS

Pin	Signal
1	NVDIMM_IIC_SCL
2	NVDIMM_IIC_SDA
3	PRESENT#
4	GTG
5,6,7	GND
8,9,10	VBUS

8. Pin Description

Signal Name	Signal Type	Pin Number	Pin Description
NVDIMM_IIC_SCL	Input	1	NVDIMM I2C slave interface, clock
NVDIMM_IIC_SDA	Input / Output	2	NVDIMM I2C slave interface, data I/O
PRESENT#	Output	3	The AGIGARAM can read this signal to determine if the PowerGEM is present; Reading a low voltage level, means PowerGEM is connected, and reading a high voltage level means PowerGEM is not connected.
GTG	Output	4	Active High signal indicating that PowerGEM is operational, fully charged and ready to supply power to NVDIMM for a save operation during a Power failure.
GND	Power	5	Ground
VBUS	Power	6	This is a multifunction pin that provides 12V power from the host to the PowerGEM during normal operation and provides capacitor output voltage from the hybrid supercapacitor to the NVDIMM when there is a power loss scenario.

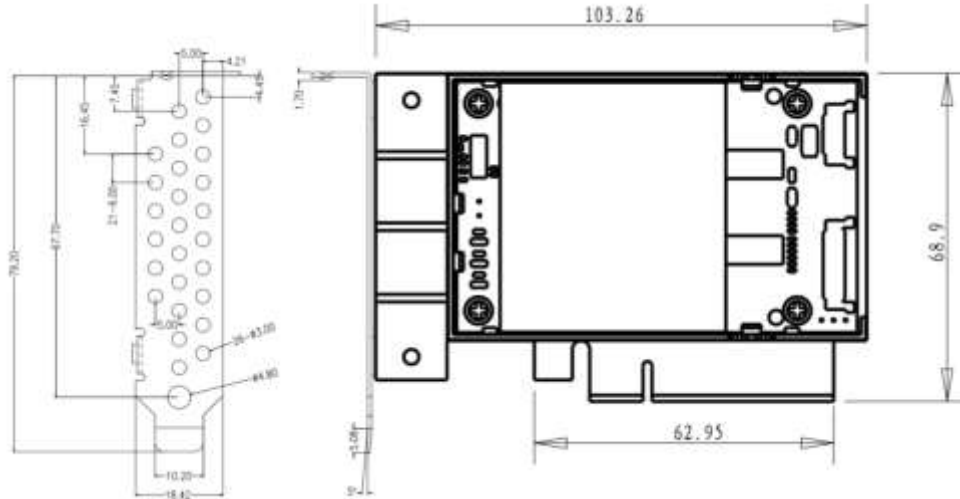
9. Mechanical



Dimensions are in mm with below tolerance unless otherwise stated.

- | | |
|------------------|-------------------|
| >0-5 +/- 0.10 | >120-200 +/- 0.50 |
| >5-30 +/- 0.15 | >200-300 +/- 0.80 |
| >30-70 +/- 0.20 | >300-400 +/- 0.95 |
| >70-120 +/- 0.30 | >400-900 +/- 1.10 |

Figure 4. Mechanical Dimensions



Dimensions are in mm with below tolerance unless otherwise stated.

- | | |
|------------------|-------------------|
| >0-5 +/- 0.10 | >120-200 +/- 0.50 |
| >5-30 +/- 0.15 | >200-300 +/- 0.80 |
| >30-70 +/- 0.20 | >300-400 +/- 0.95 |
| >70-120 +/- 0.30 | >400-900 +/- 1.10 |

Figure 5. PCIe Bracket Dimensions

10. Cable Spec

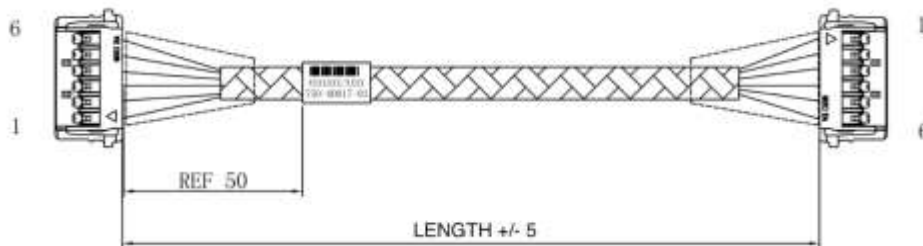


Figure 6. 6-pin Cable Drawing (for Master and Shared port connections)

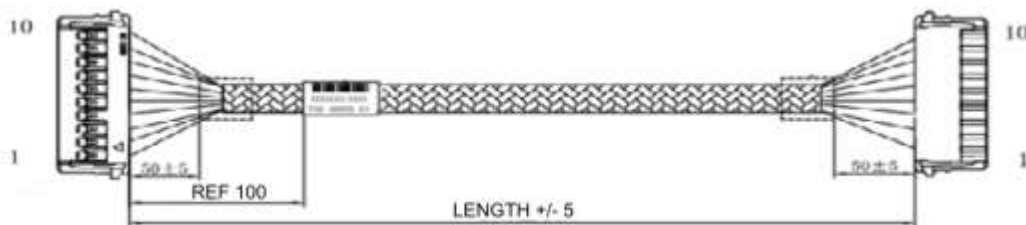


Figure 7. 10-pin Cable Drawing (for Central Power operation)

Length = See table below

Current rating 2.5A

Voltage rating 50V DC

11. Ordering Part Numbers

PART NUMBER	# of Ports	Description	Operating Conditions/Life	Cable Length(s)	DDR4 NVDIMM-N Support ^[1]
AGIGA9834-003JCA (Amber4X G-Series)	1 Master, 3 Shared	1000 F cell, no bracket, no cables	10° to 50°C, 5 years	None ^[2]	Up to 4x 8GB or Up to 4x 16GB or Up to 2x 32GB
AGIGA9834-033JCA (Amber4Xc G-Series)	1 Central Power	1000 F cell, no bracket, central power cable	10° to 50°C, 5 years	Central Power Cable 190mm	Up to 4x 8GB or Up to 4x 16GB or Up to 2x 32GB
AGIGA9834-103JCA (Amber4Xd G-Series)	1 Master, 3 Shared	1000 F cell, 2.5" drive case, no cables	10° to 50°C, 5 years	None ^[2]	Up to 4x 8GB or Up to 4x 16GB or Up to 2x 32GB
AGIGA9834-203JCA (Amber4Xe G-Series)	1 Master, 3 Shared	1000 F cell, half- height, half-length PCIe bracket, no cables	10° to 50°C, 5 years	None ^[2]	Up to 4x 8GB or Up to 4x 16GB or Up to 2x 32GB

[1] Assumes AGIGARAM NVDIMM-Ns. 3rd party NVDIMM-N modules may have different power requirements.

[2] Cables can be ordered individually.