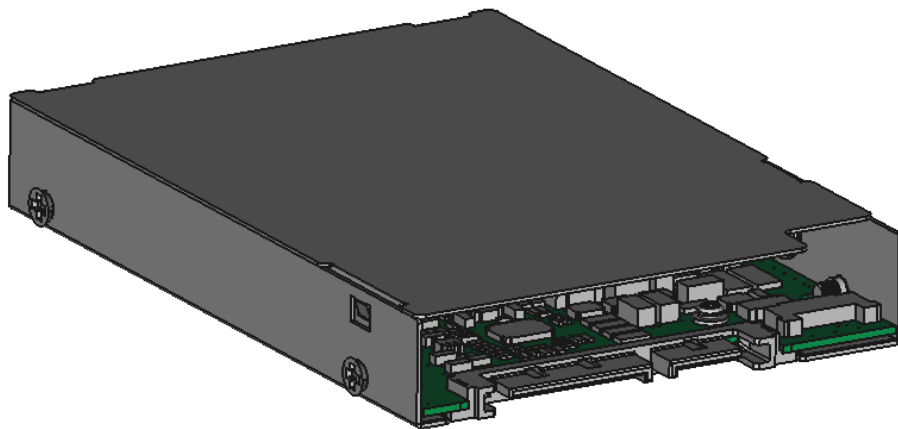


***Diamond4* PowerGEM® Ultracapacitor Module
(for use with AGIGARAM® DDR4 NVDIMM)
Datasheet**



AGIGA9811-001XX

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(for release under NDA only)**

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Revision History

Document No. Revision	Date	Description of Changes
01	07/01/14	Initial Release
02	10/08/14	Fixed Typos, updated electrical specs. Edits from Marketing
03	07/08/15	Added the "No Connect" pins in the pin out section. Added the "CCA" part number to the ordering information. Added the appropriate parameters for BCA/CCA in electrical characteristics section. Removed CCA option, added DCA option. Changed the Joule rating to EOL value instead of initial value.
04	09/30/15	Removed "Preliminary" and grayed out order info for DCA version
05	12/18/15	Changed "DCA" to "JCA" version, added part numbers for 001JCA and 002JCA, updated cable drawing
06	02/02/16	Change 002JCA part numbers to 001JCB
07	04/27/16	Added AGIGA9811-001BCB to section 11
08	05/20/16	Updated electrical specifications to reflect worst capacitor tolerance from manufacturer
09	08/31/16	Updated Mechanical drawing case thickness tolerance
10	11/06/16	Added mechanical drawing for SFF-8201 compliant case. Updated simplified block diagram. Updated LED behavior descriptions.
11	12/14/16	Added comments to reflect moving to SFF-8201 compliant case for all part numbers.
12	12/12/17	Added JCD and JCE part numbers.
13	03/07/19	Corrected Energy Characteristic values, and removed cable from JCD in ordering table, section 11. Added JCF part number.

1. Product Overview

The Diamond4 PowerGEM® (AGIGA9811-001xxx) is an ultracapacitor-based power supply for an Agiga Tech DDR4 NVDIMM. Diamond4 is designed to fit into a standard 2.5” drive carrier. There are two connectors present, one is a standard SATA connector, the other is a proprietary 6-pin connector that connects via a cable to an Agiga Tech DDR4 NVDIMM. The SATA connector is an optional connection and is not required for operation. The 6-pin connector provides power and health monitoring functionality. The module takes 12 volts in (either from the SATA connector or over the 6-pin connector through the DIMM socket) and supplies an unregulated output voltage to the NVDIMM during power fail operations.

The PowerGEM uses ultracapacitors for energy storage because they offer high power density, quick charge time and long cycle life. The Diamond4 PowerGEM uses series/parallel-connected ultracapacitors as shown in Figure 1 below.

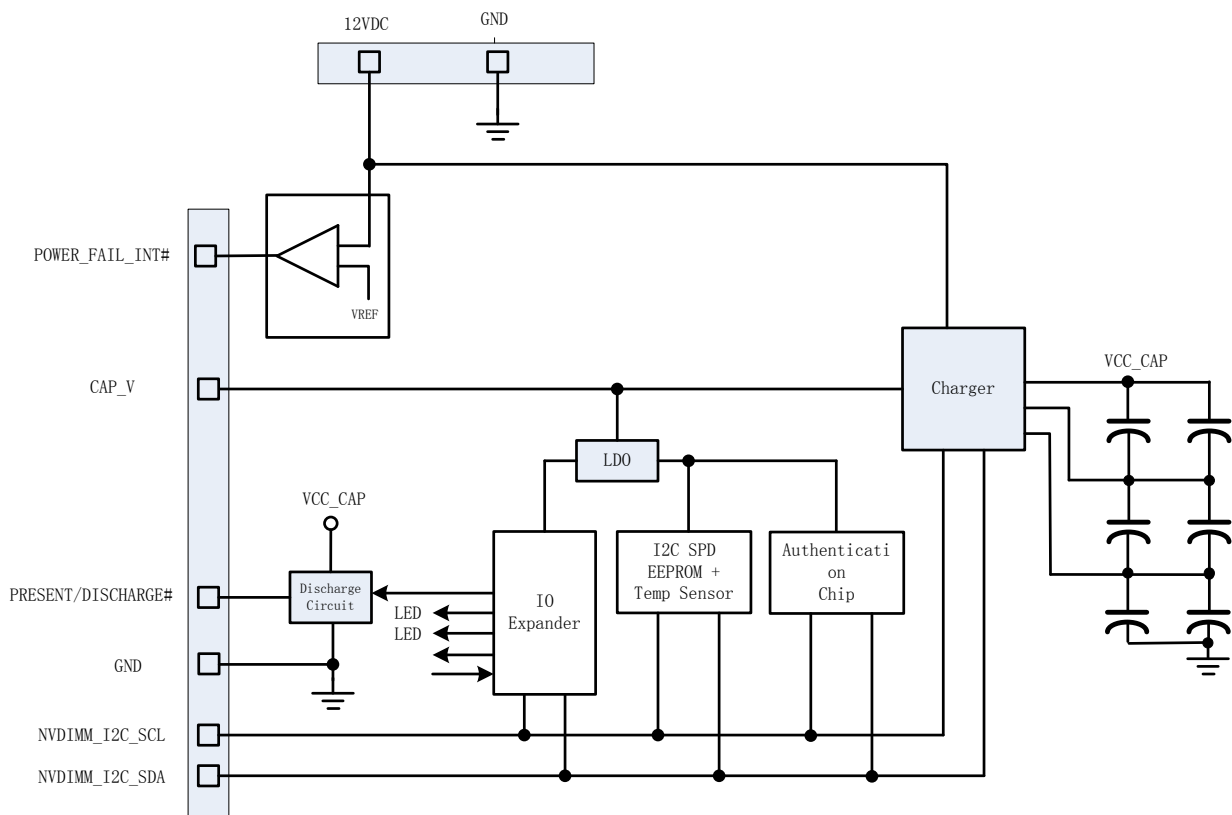


Figure 1. Simplified Diamond4 PowerGEM Diagram

2. Key Features

- Ultracapacitor module in 2.5" drive form factor
- Meets SFF-8201 mechanical specification
- Cable included
- Provides back-up power to NVDIMM during SAVE operation in the event of system power loss
- Real-time health monitoring and logging
- Safe online ultracap measurement (never taken offline during normal operation)
- Automatic ultracap discharge feature (upon disconnecting from the NVDIMM)
- Ultracaps charged from 12V SATA connection or 12V pins over DIMM interface
- Charge current 3.3A to minimize charge time
- Energy Rating: 264 Joules(BCA/BCB/JCB/JCC/JCD/JCF versions), 194.5 Joules(JCA/JCE versions)
- Operating Life: 5 years@50°C*
- Product Weight: 142.3grams
- RoHS 6/6-compliant
- UL/cUL/CB/CE compliant

* typical, can be tailored to system requirements (see section 4)

Note: must be paired with an Agiga Tech DDR4 NVDIMM or another approved Agiga Tech NVDIMM design.

3. Reference Documents

The Diamond4 PowerGEM is compatible Agiga Tech DDR4 NVDIMMs. See the NVDIMM Datasheet and Firmware Spec for details.

4. Operating Life

Diamond4 has a programmable charge voltage. The lifetime of an ultracapacitor is determined by the voltage across the cap and the operating temperature. Figure 2 below assumes Diamond4 is paired with an 8GB DDR4 AGIGARAM NVDIMM and is configured for 5 yr operating life at 50°C. For additional NVDIMM configurations, please contact AgigA Tech.

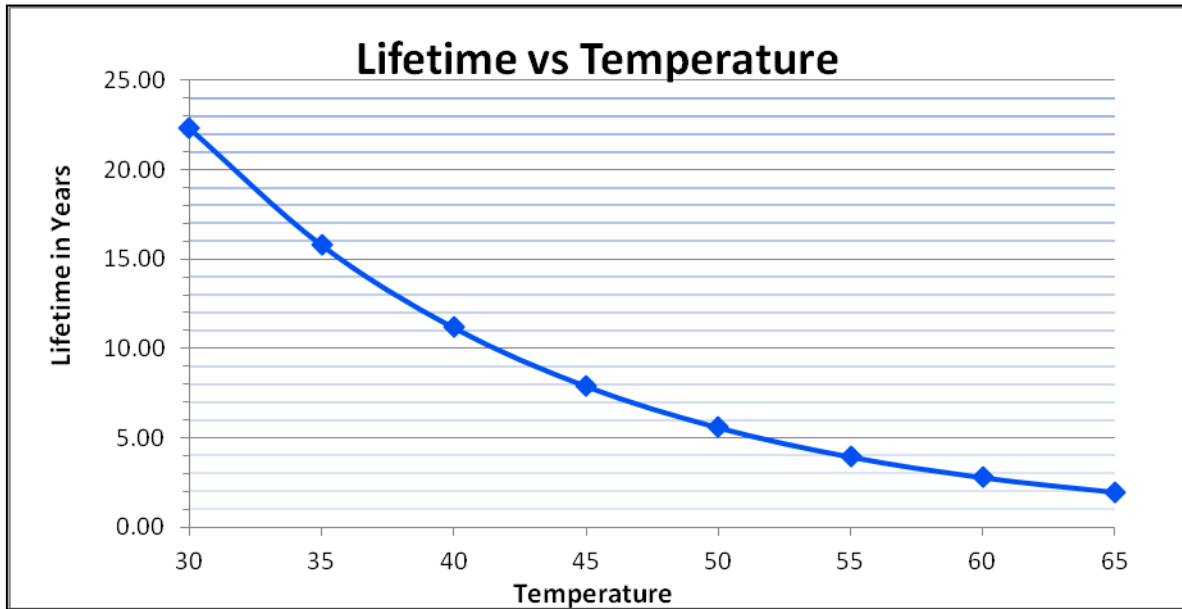


Figure 2. Life versus Temperature graph

5. Electrical Characteristics

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Input voltage range	V_i	Over I_o range	10.2	12	13.8	V
Input Supply Current	$I_{S(VIN)}$	$V_{IN} = 12V$ Including operating and charging current.	-	-	1.0	A
OUTPUT CHARACTERISTICS						
Diamond Output Voltage	V_{CAP_V}	$V_{IN} = 0V$; Voltage will drop to 2V and then shutoff.	4.4	-	7.8	V
CAPACITOR CHARACTERISTICS						
Initial Effective Capacitance	C_{INIT}	This value is the result of a capacitance measurement commanded over I2C at time of manufacture. (001BCA, 001BCB, 001JCB and 001JCC versions)	23 (100%)	-	-	F
		This value is the result of a capacitance measurement commanded over I2C at time of manufacture. (001JCA version)	17.8 (100%)	-	-	F
End Of Life Effective Capacitance	C_{EOL}	This value is 70% of Initial Effective Capacitance (001BCA, 001BCB, 001JCB and 001JCC versions)	16 (70%)	-	-	F
		This value is 70% of Initial Effective Capacitance (001JCA version)	12.5 (70%)	-	-	F
Capacitor Stack Voltage	V_{CAP_V}	Measured when capacitor stack is fully charged	-	6.6	7.8	V
Capacitor Charge Current	I_{CAP}	Charge current is adjusted to meet max Input Supply Current and minimize charge time	-	-	3.3	A
ENERGY CHARACTERISTICS**						
End Of Life Joules	$J_{EOL-USEABLE}$	Based on CEOL after 5 years at rated temp of 50°C (BCA/BCB/JCB/JCC/JCD/JCF)	264	-	-	J
		Based on CEOL after 5 years at rated temp of 50°C (JCA/JCE)	194.5	-	-	J
Charge Time	T_{CHG}	Assuming average charge current of 0.8A	-	-	254	S

****These numbers are based on the default voltage configuration for a Diamond4.**

	MIN	TYP	MAX	Notes
Operating Temperature	0°C	25°C	+65°C	1
Storage Temperature	-10°C		+65°C	2

[1] Max operating temp reflects functional limit. See section 4 for temperature impact on operating lifetime. For example, 5 year lifetime is expected at 50°C max operating temp.

[2] 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%

6. LED Functional Description

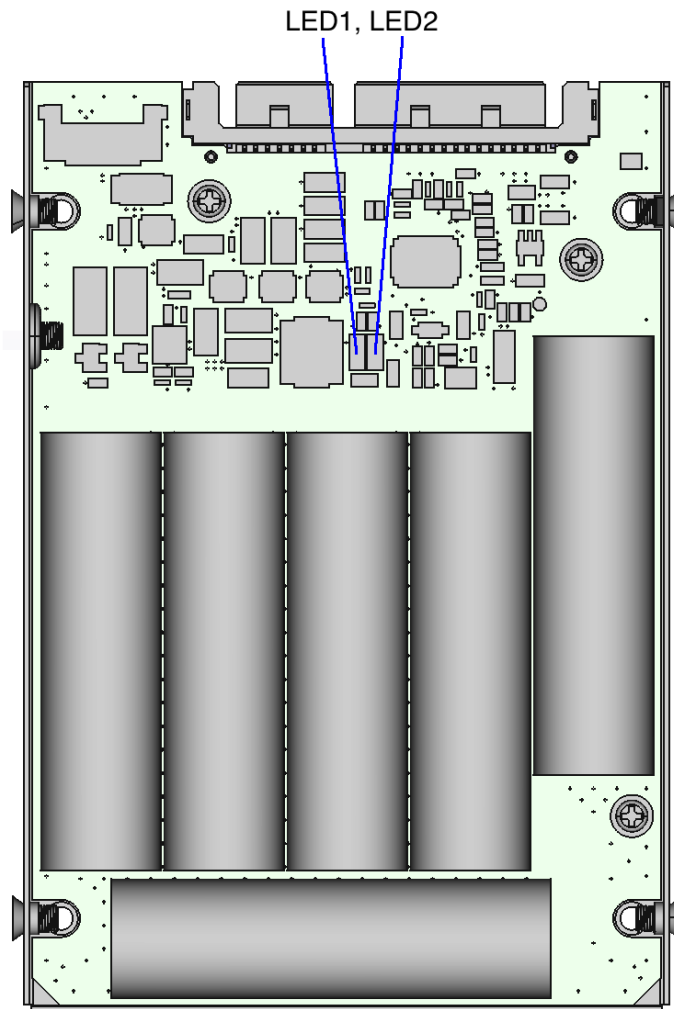


Figure 3. LED Locations

LED1 – When on, indicates that the PowerGEM either has 12V available or Cap Voltage available.

LED2 – When off, indicates that the discharge resistor has been turned on by software. This would typically only be done during a capacitance measurement.

7. Pin Layout

Pinout for standard SATA input power connector:

Pin	Signal
S1	No Connect
S2	No Connect
S3	No Connect
S4	No Connect
S5	No Connect
S6	No Connect
S7	No Connect
P1	No Connect
P2	No Connect
P3	No Connect
P4	GND
P5	GND
P6	GND
P7	No Connect
P8	No Connect
P9	No Connect
P10	GND/No Connect*
P11	No Connect
P12	GND
P13	12VDC
P14	12VDC
P15	12VDC

*BCA/JCA

Pinout for the “J2” Custom 6-pin connector to the NVDIMM:

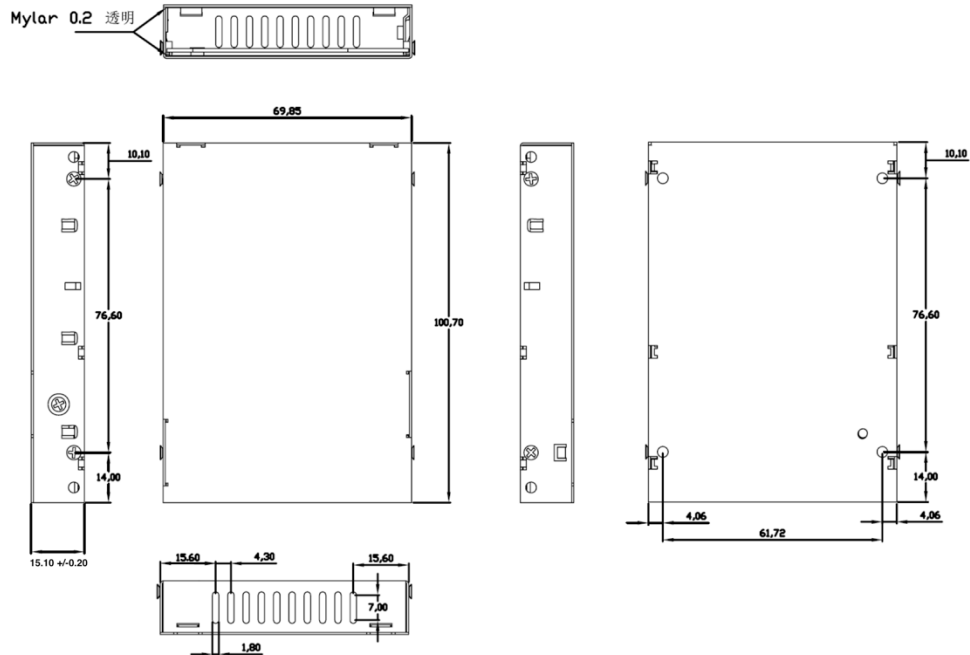
Pin	Signal
1	NVDIMM_IIC_SCL
2	NVDIMM_IIC_SDA
3	PRESENT/DISCHARGE#
4	POWER_FAIL_INT#
5	GND
6	CAP_V

8. Pin Description

Signal Name	Signal Type	Pin Number	Pin Description
SATA Connector Signals			
12VDC	Power	P13, P14, P15	12V Input power
GND	Power	P4, P5, P6, P10, P12	Ground
6 Pin Connector Signals			
NVDIMM_IIC_SCL	Input	1	NVDIMM I2C slave interface, clock
NVDIMM_IIC_SDA	Input/Output	2	NVDIMM I2C slave interface, data I/O
PRESENT/DISCHARGE#	Input/Output	3	This open drain signal can be used by AGIGARAM to force the PowerGEM to begin discharging by driving it to ground. 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. If no AGIGARAM is present, this signal is pulled to ground via resistor which also causes the capacitor array to discharge.
POWER_FAIL_INT#	Output	4	Active Low signal indicating that input power is below a defined threshold. Detect power loss and sends interrupt to NVDIMM
GND	Power	5	Ground
CAP_V	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 ultracaps to the NVDIMM when there is a power loss scenario.

9. Mechanical

Standard Case(Dimensions are in mm)



SFF-8201 Compliant Case

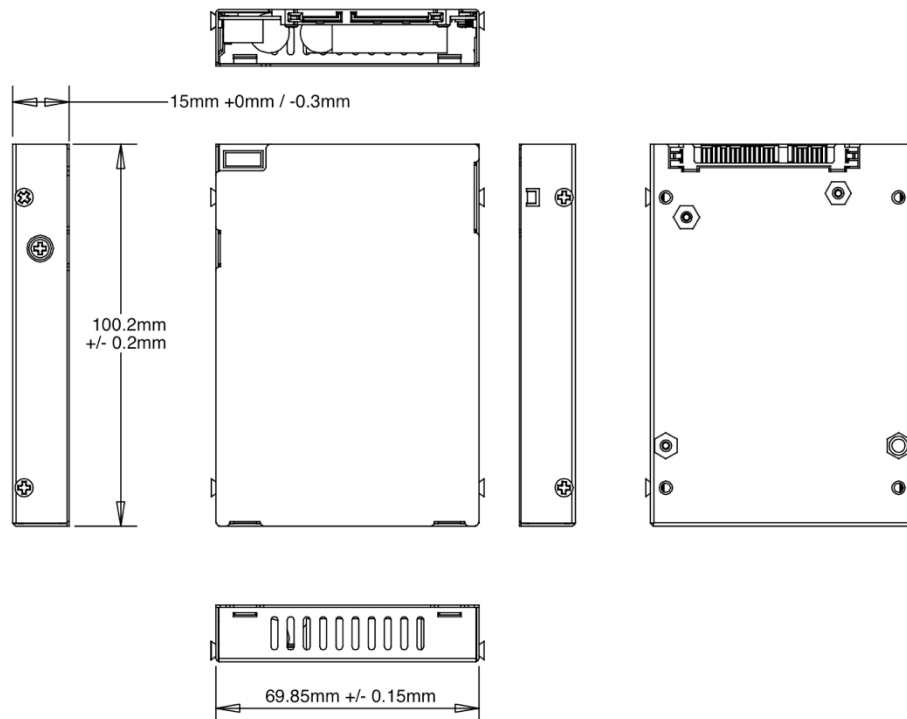


Figure 4. Mechanical Drawing

10. Cable Spec

Dimensions are in mm

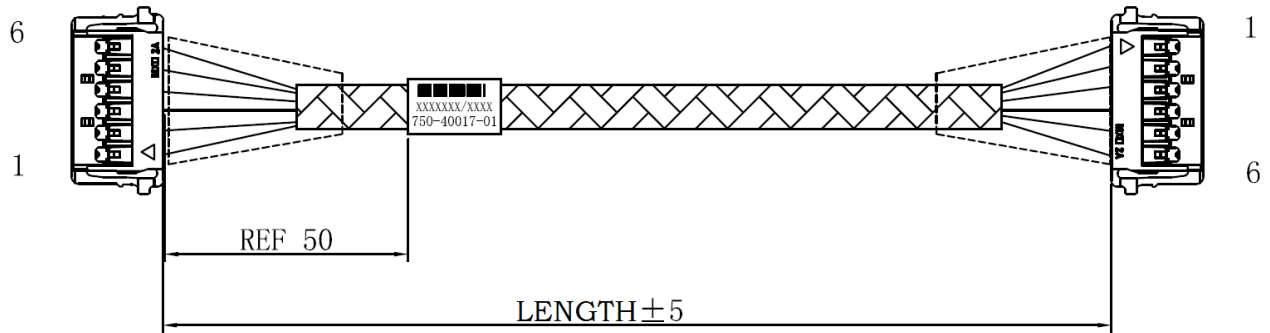


Figure 5. Cable Drawing

Length: see part number information in section 11

Current rating 2.5A

Voltage rating 50V AC

Note: The cable protective covering has been updated from solid shrink tubing to braided wrap to improve flexibility. There is no change to electrical specifications or safety and environmental compliance.

11. Ordering Part Numbers

PART NUMBER	Joules Rating (@ EOL)	Case	Cable Length	DDR4 NVDIMM Support	Other
AGIGA9811-001BCA	264 Joules	SFF-8201 compliant	750mm	8/16GB Legacy	See Notes 1,2,4
AGIGA9811-001BCB	264 Joules	SFF-8201 compliant	355mm	8/16GB Legacy	See Notes 1,2,4
AGIGA9811-001JCA	194.5 Joules	SFF-8201 compliant	750mm	8GB Legacy or JEDEC	See Notes 3,4
AGIGA9811-001JCB	264 Joules	SFF-8201 compliant	750mm	8GB/16GB Legacy or JEDEC	See Notes 3,4
AGIGA9811-001JCC	264 Joules	SFF-8201 compliant	355mm	8GB/16GB Legacy or JEDEC	See Note 3
AGIGA9811-001JCD	264 Joules	SFF-8201 compliant	No Cable Provided	8GB/16GB Legacy or JEDEC	See Note 3
AGIGA9811-001JCE	194.5 Joules	SFF-8201 compliant	560mm	8GB Legacy or JEDEC	See Note 3
AGIGA9811-001JCF	264 Joules	SFF-8201 compliant	560mm	8GB/16GB Legacy or JEDEC	See Note 3

Notes:

1. Not recommended for new designs, please use -001JCx versions
2. Pin P10 in SATA connector is grounded
3. Pin P10 in SATA connector is not connected
4. Date codes prior to 1702 will have the Standard case dimensions shown in Section 9. Units shipped on or after 1702 will meet the SFF-8201 specification. A sample label is shown below with the date code underlined in red. The label is affixed to the outer case of the PowerGEM.

