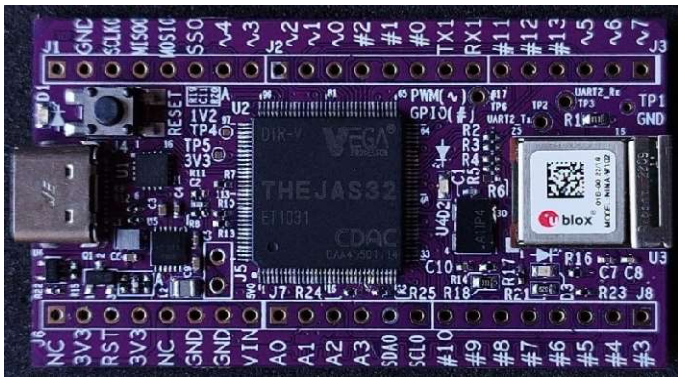
Product Reference Manual



Description

The ARIES NOVA v1.0 is a fully indigenous and a “Made in India” product to get started with basic microprocessor programming and embedded systems. This board is built upon a RISC-V ISA compliant VEGA Processor with easy-to-use hardware and software. The VEGA SDK also provides full ecosystem with numerous examples and support documentation. This board is designed and developed by Centre for Development of Advanced Computing (C-DAC) as part of the Digital India RISC-V (DIR-V) Program, by the Ministry of Electronics and Information Technology, Government of India.

Target areas/Applications

Low power IoT, Sensor fusion, Smart Meter, System supervisors, Remote sensors, Wearable devices, Toy and electronic education equipment, Legacy 8/16-bit applications, Industrial networking and many more…

Board overview

Controller	THEJAS32
SRAM	256KB
Flash	2MB
Input voltage	5.5V
PWM pins	8nos
Analog Input pins	4nos
SPI	1nos
UART	2nos
I2C	1nos
GPIO	15nos
DC Current per I/O pin	12mA
IO Voltage	3.3V
Clock speed	100MHz
Length	58mm
Width	32mm

On board interfaces
Bluetooth v4.2-WiFi 802.11b/g/n (NINA-W102-01B)
IC Authentication chip (ATECC608A)
3D accelerometer and 3D gyroscope (LSM6DSLTR)

NINA-W102-01B Module (WIFI AND BLUETOOTH MODULE)

- Dual-core 32-bit MCU
- Operating supply voltage: 3V -3.6V
- Dual/quad SPI
- This radio provides support for Wi-Fi 802.11b/g/n in the 2.4 GHz ISM band and Bluetooth v4.2
- 448 Kbyte ROM and 520 Kbyte SRAM
- 16/32 Mbit FLASH and 1 kbit EFUSE (non-erasable memory)
- 2.4 GHz PIFA antenna

ATECC608A- Crypto Authentication

- Cryptographic Co-Processor with Secure Hardware-Based Key Storage: Protected storage for up to 16 keys, certificates or data
- Two Interface Options Available: – High-speed Single Pin Interface with One GPIO Pin – 1 MHz Standard I2C Interface
- Internal High-Quality NIST SP 800-90A/B/C Random Number Generator (RNG)
- Two High-Endurance Monotonic Counters
- Unique 72-Bit Serial Number
- 1.8V to 5.5V IO Levels, 2.0V to 5.5V Supply Voltage

LSM6DSLTR-iNEMO inertial module: always-on 3D accelerometer and 3D gyroscope

- 3D digital accelerometer and a 3D digital gyroscope performing at 0.65 mA in high-performance mode
- Analog supply voltage: 1.71 V to 3.6 V
- SPI & I2C serial interface with main processor data synchronization feature
- Smart FIFO up to 4 Kbytes based on features set
- low power consumption for both accelerometer and gyroscope

CONTENTS

1. The Board

ARIES NOVA v1.0 is a development platform based on THEJAS32 ASIC which operates at a frequency of 100MHz. THEJAS32 SoC includes VEGA ET1031 Microprocessor, 256KB internal SRAM, Three UARTs, Four SPIs, Three TIMERs, Eight PWMs, Three I2C interfaces, 32 GPIOs etc. This board contains everything needed to support standalone operation. To get started simply connect the board to a computer with a Micro-C USB Cable or a battery.

2. Handling the Board

To avoid causing any damage or malfunctions; it is important to be mindful of the following points when handling or operating the board:

- To prevent any damage make sure to handle the board while taking electrostatic discharge (ESD) precautions.
- Power down the board by disconnecting the board from USB port.

2.1 Recommended Operating Conditions

Symbol	Description	Min	Max
	Conservative thermal limits for the whole board:	-0 °C (100°F)	85 °C (185°F)

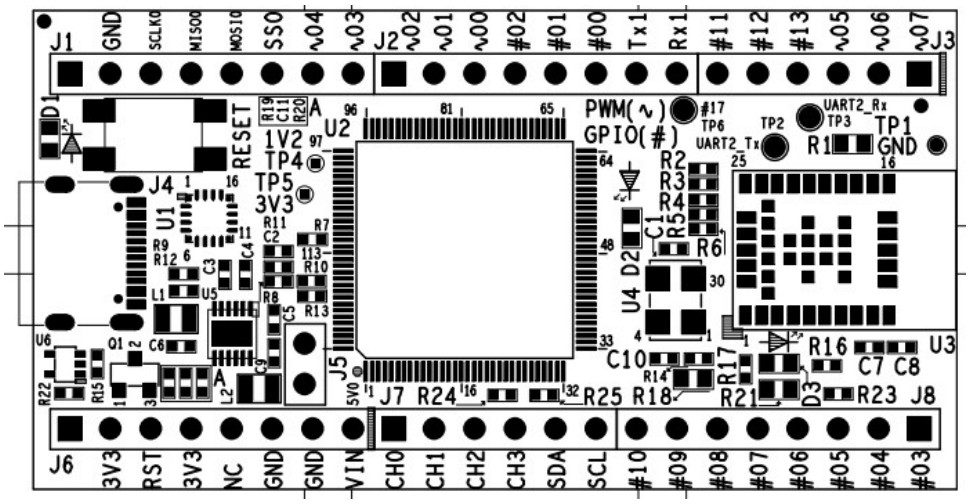
2.2 Power Consumption

Symbol	Description	Min	Type	Max	Unit
VINMax	Maximum input voltage from VIN pad	-	-	5.5	V
VUSBMax	Maximum input voltage from USB connector	-	5.5	-	V
PMax	DC Current per I/O Pin	-	-	12	mA

3. Functional Overview

3.1 Board Topology

Top view



Ref.	Description	Ref.	Description
U3	WiFi	U2	THEJAS32 SoC
J64	USB C Connector	D1	Processor Heartbeat LED
J5	Boot Select Header	U4	100 MHz Oscillator
RESET	Reset Button	U5	SPI Boot Flash Memory
U1	USB to UART IC	U6	OPAMP
U3	WiFi	U2	THEJAS32 SoC

3.2 Processor

The main controller is THEJAS32 SoC which operates at a frequency of 100MHz. It includes VEGA ET1031 Microprocessor, 256KB internal SRAM, Three UARTs, Four SPIs, Three TIMERs, Eight PWMs, Three I2C interface, 32 GPIOs. Most of its pins are connected to the external headers however some are reserved for internal communication.

3.3 THEJAS32 Pinout

Pin #	Pin Name	Pin Description	Type
1	GPIO19	General purpose IO GPIO1 (3).	I/O
2	GPIO18	General purpose IO GPIO1 (2).	I/O
3	VSSIO	Ground reference for IO pins.	S
4	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
5	GPIO17	General purpose IO GPIO1 (1).	I/O
6	GPIO16	General purpose IO GPIO1 (0).	I/O
7	SPI_MOSI3	SPI 3 Master Out Slave In.	O
8	VDD	Positive supply for logic. Connect to 1.2V supply.	S
9	VSS	Ground reference for logic.	S
10	SPI_MISO3	SPI 3 Master In Slave Out.	I
11	SPI_SCLK3	SPI 3 Clock.	O
12	SPI_SS3	SPI 3 Chip Select.	O
13	VSSIO	Ground reference for IO pins.	S
14	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
15	BOOT_SEL	Boot select.	I
16	PROC_HB	Heartbeat signal.	O
17	RFIU1	Connect to GND.	NA
18	VDD	Positive supply for logic. Connect to 1.2V supply.	S
19	VSS	Ground reference for logic.	S

20	RFIU2	Connect to GND through a 1K resistor.	NA
21	RFIU3	JTAG TDO. Left unconnected.	NA
22	RFIU4	JTAG TMS. Connect to GND through a 1K resistor.	NA
23	RFIU5	JTAG TDI. Connect to GND through a 1K resistor.	NA
24	VSSIO	Ground reference for IO pins.	S
25	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
26	VDD	Positive supply for logic. Connect to 1.2V supply.	S
27	VSS	Ground reference for logic.	S
28	RFIU6	JTAG TCK. Connect to GND through a 1K resistor	NA
29	RFIU7	JTAG TRST. Connect to GND through a 1K resistor	NA
30	RFIU8	Test mode select. Connect to GND through a 1K resistor.	NA
31	I2C_SDA2	I2C 2 Serial Data.	I/O
32	I2C_SCL2	I2C 2 Serial Clock.	I/O
33	I2C_SCL0	I2C 0 Serial Clock.	I/O
34	I2C_SDA0	I2C 0 Serial Data.	I/O
35	VSS	Ground reference for logic.	S
36	VDD	Positive supply for logic. Connect to 1.2V supply.	S
37	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
38	VSSIO	Ground reference for IO pins.	S
39	SPI_SS1	SPI 1 Chip Select.	O

40	SPI_SCLK1	SPI 1 Clock.	O
41	SPI_MISO1	SPI 1 Master In Slave Out.	I
42	SPI_MOSI1	SPI 1 Master Out Slave In.	O
43	PUSH_RESET N	Reset. (ACTIVE LOW)	I
44	CLK	System Clock.	I
45	UART_TX1	UART 1 Serial Out / Transmit.	O
46	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
47	VSSIO	Ground reference for IO pins.	S
48	VSS	Ground reference for logic.	S
49	VDD	Positive supply for logic. Connect to 1.2V supply.	S
50	UART_RX1	UART 1 Serial In / Receive.	I
51	GPIO15	General purpose IO GPIO0(15).	I/O
52	GPIO14	General purpose IO GPIO0(14).	I/O
53	GPIO13	General purpose IO GPIO0(13).	I/O
54	GPIO12	General purpose IO GPIO0(12).	I/O
55	GPIO11	General purpose IO GPIO0(11).	I/O
56	VSS	Ground reference for logic.	S
57	VDD	Positive supply for logic. Connect to 1.2V supply.	S
58	GPIO10	General purpose IO GPIO0(10).	I/O
59	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
60	VSSIO	Ground reference for IO pins.	S
61	GPIO9	General purpose IO GPIO0(9).	I/O

62	GPIO8	General purpose IO GPIO0(8).	I/O
63	GPIO7	General purpose IO GPIO0(7).	I/O
64	GPIO6	General purpose IO GPIO0(6).	I/O
65	GPIO5	General purpose IO GPIO0(5).	I/O
66	GPIO4	General purpose IO GPIO0(4).	I/O
67	VSS	Ground reference for logic.	S
68	VDD	Positive supply for logic. Connect to 1.2V supply.	S
69	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
70	VSSIO	Ground reference for IO pins.	S
71	GPIO3	General purpose IO GPIO0 (3).	I/O
72	GPIO2	General purpose IO GPIO0 (2).	I/O
73	GPIO1	General purpose IO GPIO0 (1).	I/O
74	GPIO0	General purpose IO GPIO0 (0).	I/O
75	PWM_7	Pulse Width Modulation.	O
76	PWM_6	Pulse Width Modulation.	O
77	PWM_5	Pulse Width Modulation.	O
78	VSS	Ground reference for logic.	S
79	VDD	Positive supply for logic. Connect to 1.2V supply.	S
80	PWM_4	Pulse Width Modulation.	O
81	PWM_3	Pulse Width Modulation.	O
82	PWM_2	Pulse Width Modulation.	O
83	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
84	VSSIO	Ground reference for IO pins.	S

85	PWM_1	Pulse Width Modulation.	O
86	PWM_0	Pulse Width Modulation.	O
87	SPI_MOSI0	SPI 0 Master Out Slave In.	O
88	VSS	Ground reference for logic.	S
89	VDD	Positive supply for logic. Connect to 1.2V supply.	S
90	SPI_MISO0	SPI 0 Master In Slave Out.	I
91	SPI_SCLK0	SPI 0 Clock.	O
92	SPI_SS0	SPI 0 Chip Select.	O
93	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
94	VSSIO	Ground reference for IO pins.	S
95	I2C_SDA1	I2C 1 Serial Data.	I/O
96	I2C_SCL1	I2C 1 Serial Clock.	I/O
97	SPI_MOSI2	SPI 2 Master Out Slave In.	O
98	SPI _MISO2	SPI 2 Master In Slave Out.	I
99	VDD	Positive supply for logic. Connect to 1.2V supply.	S
100	VSS	Ground reference for logic.	S
101	SPI_SCLK2	SPI 2 Clock.	O
102	SPI_SS2	SPI 2 Chip Select.	O
103	VSSIO	Ground reference for IO pins.	S
104	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
105	UART_RX2	UART 2 Serial In / Receive.	I
106	UART_TX2	UART 2 Serial Out / Transmit.	O
107	UART_RX0	UART 0 Serial In / Receive.	I

108	UART_TX0	UART 0 Serial Out / Transmit.	O
109	GPIO31	General purpose IO GPIO1 (15).	I/O
110	GPIO30	General purpose IO GPIO1 (14).	I/O
111	GPIO29	General purpose IO GPIO1 (13).	I/O
112	VDD	Positive supply for logic. Connect to 1.2V supply.	S
113	VSS	Ground reference for logic.	S
114	VSSIO	Ground reference for IO pins.	S
115	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
116	GPIO28	General purpose IO GPIO1 (12).	I/O
117	GPIO27	General purpose IO GPIO1 (11).	I/O
118	GPIO26	General purpose IO GPIO1 (10).	I/O
119	GPIO25	General purpose IO GPIO1 (9).	I/O
120	GPIO24	General purpose IO GPIO1 (8).	I/O
121	GPIO23	General purpose IO GPIO1 (7).	I/O
122	GPIO22	General purpose IO GPIO1 (6).	I/O
123	VSSIO	Ground reference for IO pins.	S
124	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
125	VDD	Positive supply for logic. Connect to 1.2V supply.	S
126	VSS	Ground reference for logic.	S
127	GPIO21	General purpose IO GPIO1 (5).	I/O
128	GPIO20	General purpose IO GPIO1 (4).	I/O

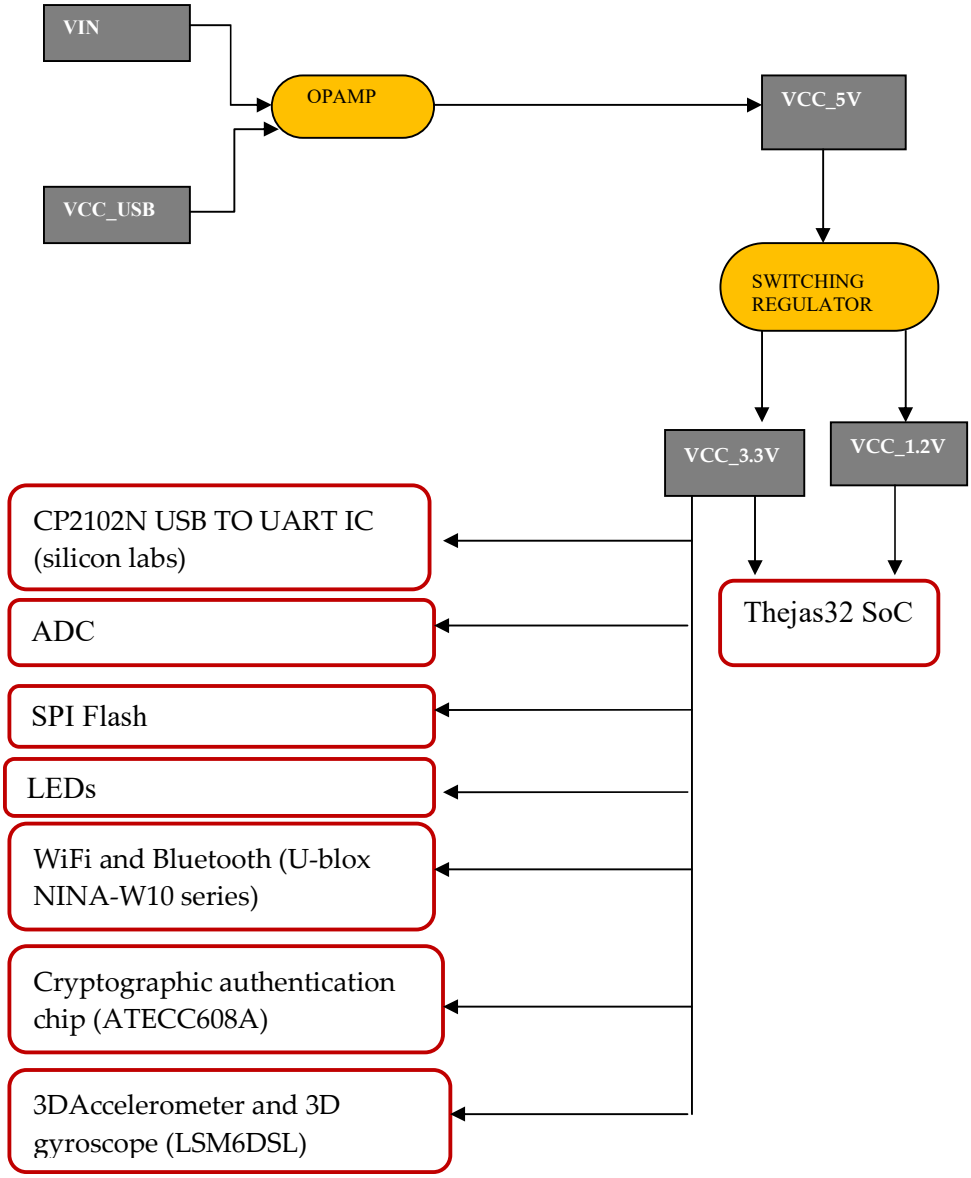
S- Supply, I/O - Input/output, I - Input, O - Output, RFIU - Reserved for internal use

4. Board Operation

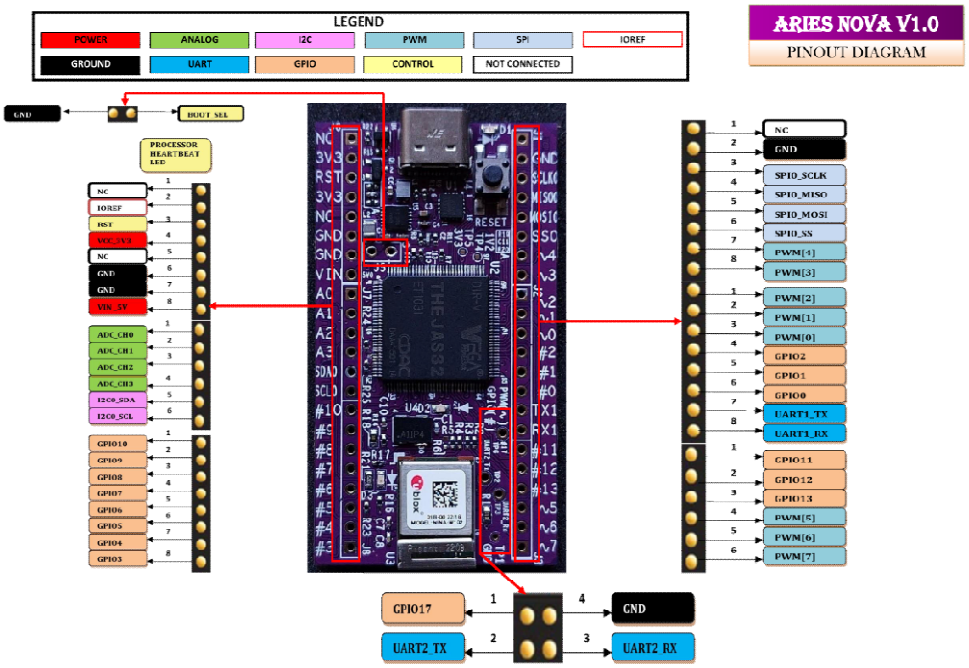
4.1 Getting Started

- To use Vega Arduino IDE for programming follow the steps given in the link below
  - For Linux; https://bit.ly/vega-linux
  - For Windows; https://bit.ly/vega-windows
- To use Eclipse IDE for programming follow the steps given in the link below
  - https://cdac-vega.gitlab.io/sdkuserguide.html

5. Block diagram



6. Connector Pinouts

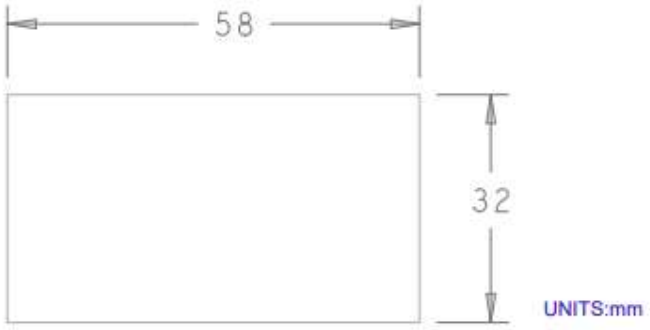


SL No.	SPECIFICATIONS	THEJAS 32	ARIES BOARD	REMARKS
1	SPI (3)	SPI_SS0	J1_6	Connected to HEADER J1
2		SPI_SCLK0	J1_3	
3		SPI_MISO0	J1_4	
4		SPI_MOSI0	J1_5	
5		SPI_SS1	U3_28	Connected to WIFI (U3) Module
6		SPI_SCLK1	U3_29	
7		SPI_MISO1	U3_1	
8		SPI_MOSI1	U3_21	
13		SPI_SS3	U8_1	Connected to SPI BOOT FLASH IC
14		SPI_SCLK3	U8_6	
15		SPI_MISO3	U8_2	
16		SPI_MOSI3	U8_5	

17	I2C (3)	SCL0	J7_6	Connected to HEADER J7
18		SDA0	J7_5	
19		SCL1	U7_13	Connected to Accelerometer (U7)
20		SDA1	U7_14	
21		SCL2	U10_10,U9_6	Connected to I2C ADC IC(U10) and Authentication IC(U9)
22		SDA2	U10_9,U9_5	
23	UART (3)	UART_RX0	U11_18	Connected to UART TO USB INTERFACE IC
24		UART_TX0	U11_17	
25		UART_RX1	J2_8	Connected to HEADER J2
26		UART_TX1	J2_7	
27		UART_RX2	TP3	Connected to Test points
28		UART_TX2	TP2	
29	PWM (8)	PWM_0	J2_3	Connected to HEADER J2
30		PWM_1	J2_2	
31		PWM_2	J2_1	
32		PWM_3	J1_8	Connected to HEADER J1
33		PWM_4	J1_7	
34		PWM_5	J3_3	Connected to HEADER J3
35		PWM_6	J3_2	
36		PWM_7	J3_1	
37	GPIO	GPIO0	J2_6,U7_4	Connected to HEADER J2
38		GPIO1	J2_5,U7_9	
39		GPIO2	J2_4	
40		GPIO3	J8_1	Connected to

41		GPIO4	J8_2	HEADER J8
42		GPIO5	J8_3	
43		GPIO6	J8_4	
44		GPIO7	J8_5	
45		GPIO8	J8_6	
46		GPIO9	J8_7	
47		GPIO10	J8_8	
48	GPIO	GPIO11	J3_6	Connected to HEADER J3
49		GPIO12	J3_5	
50		GPIO13	J3_4	
51		GPIO16	U3_7	Connected to WIFI (U3) Module
52		GPIO17	TP6	
53		GPIO20	U3_19	Connected to WIFI (U3) Module
54	CLOCK	CLK_100M	U4_3	Connected to OSCILLATOR
55	RESET	PUSH_RESETN	U1_2	Connected to UART TO USB INTERFACE IC & RESET
56	HEART BEAT LED	PROC_HEART_BEAT	D3_1	Connected to LED
57	BOOT SELECT	BOOT_SEL	J5_1	Connected to HEADER J5
58	ADC_CH0	_	J7_1,U10_4	ANALOG INPUTS Connected to HEADER J7 & I2C ADC IC
59	ADC_CH1	-	J7_2,U10_5	
60	ADC_CH2	-	J7_3,U10_6	
61	ADC_CH3	-	J7_4,U10_7	

6.1 Board Outline & Mounting Holes



(Dimensions in mm[mil])

7. Company Information

Company name	**C-DAC**
Company Address	Hardware Design Group Centre for Development of Advanced Computing (C-DAC) Thiruvananthapuram, Kerala – 695033 Fax: 0471-2723456 Email: vega@cdac.in www.vegaprocessors.in www.cdac.in

8. Reference Documentation

Reference	**Link**
ARIES NOVA V1.0 details	