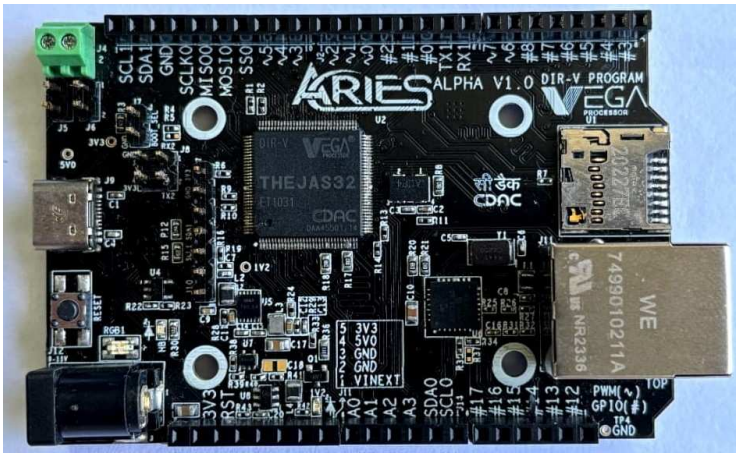
Product Reference Manual



Description

The ARIES ALPHA 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	7-12V
PWM pins	8nos
Analog Input pins	4nos
SPI	1nos
UART	2nos
I2C	2nos
GPIO	15nos
RGB	1nos (3x GPIO)
DC Current per I/O pin	12mA
IO Voltage	3.3V
Clock speed	100MHz
Length	80mm
Width	54mm

On board interfaces
Stand-Alone Ethernet Controller with SPI Interface (IEEE 802.3™ Compatible Ethernet Controller)
Stand-Alone CAN Controller with SPI Interface (CAN V2.0B at 1 Mb/s)
SD card reader

ENC28J60-I/ML Module (Stand-Alone Ethernet Controller with SPI Interface)

- IEEE 802.3™ Compatible Ethernet Controller

- Fully Compatible with 10/100/1000Base-T Networks
- Integrated MAC and 10Base-T PHY
- Supports One 10Base-T Port with Automatic Polarity Detection and Correction
- Supports Full and Half-Duplex modes
- SPI Interface with Clock Speeds up to 20 MHz
- Operating Voltage of 3.1V to 3.6V (3.3V typical)
- 5V Tolerant Inputs
- Temperature Range: -40°C to +85°C Industrial, 0°C to +70°C Commercial **(SSOP** only)

MCP2515T-I/ML Module (Stand-Alone CAN Controller with SPI Interface)

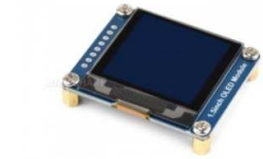
- Implements CAN V2.0B at 1 Mb/s:
    i. 0 to 8-byte length in the data field
    ii. Standard and extended data and remote frames
- High-Speed SPI Interface (10 MHz): - SPI modes 0, 0 and 1, 1
- Low-Power CMOS Technology
- Operates from 2.7V-5.5V
- 5 mA active current (typical)
- 1 µA standby current (typical) (Sleep mode)
- Temperature Ranges Supported:
    i. Industrial (I): -40°C to +85°C
    ii. Extended (E): -40°C to +125°C

5033981892 (Micro SD Memory Card Connector)

- 1.10mm Pitch micro SD Memory Card Connector, Normal Mount Surface Mount, Push-Push Type, 1.28mm Height
- SPI Interface
- Current - Maximum per Contact- 0.5A
- Voltage - Maximum -10V AC (RMS)/DC
- Temperature Range - Operating -25° to +85°C

1.5inch OLED display Module

- Controller: SSD1327
- Support interface: 4-wire SPI/I2C
- Resolution: 128 x 128
- Display size: 1.5inch
- Dimensions: 44.5mm * 37mm
- Display color: 16-bit grayscale
- Working voltage: 3.3V/5V



The board communicates with the display using I2C interface. The board includes designated mounting holes for attaching the display. The below figure shows the mounting holes.

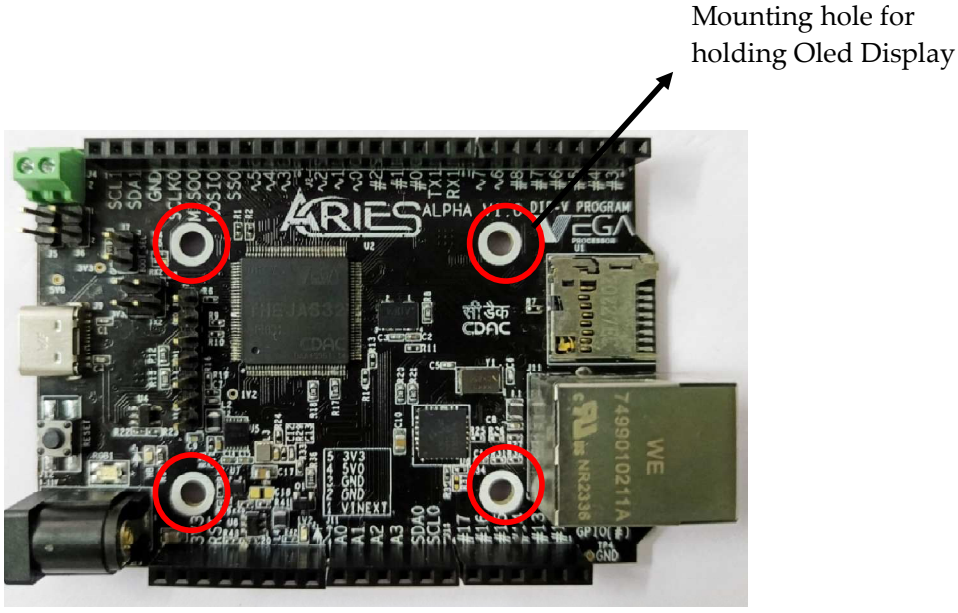


Fig: Board mounting holes.

CONTENTS

1. The Board

ARIES ALPHA 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 power it with an AC/DC adapter 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)

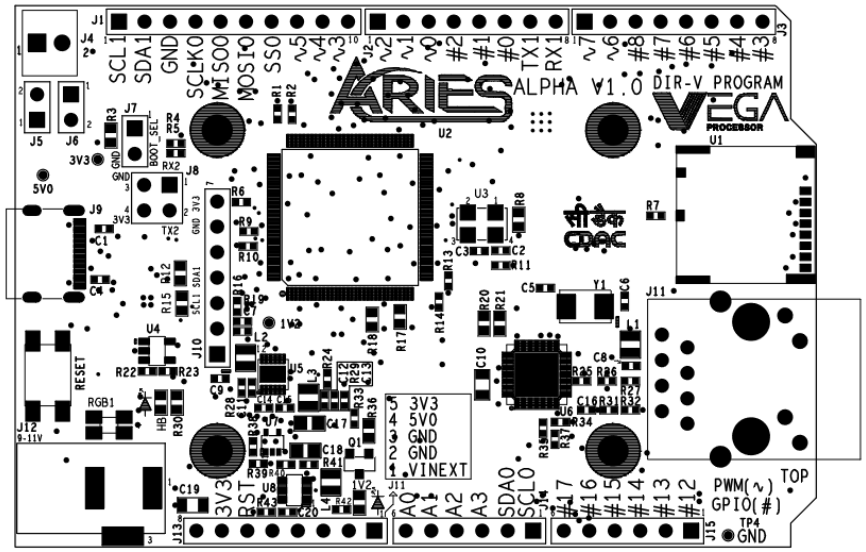
2.2 Power Consumption

Symbol	Description	Min	Typ	Max	Unit
VINMax	Maximum input voltage from VIN pad	7	-	12	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
J11	RJ45 CONNECTOR	U2	THEJAS32 SoC
J9	USB C Connector	J12	Power Jack
J7	Boot Select Header	U3	100 MHz Oscillator
RESET	Reset Button	Y1	Crystal
RGB1	RGB LED	U1	Micro SD card reader
HB	Processor Heart Beat LED	1V2	Power LED

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_RESETN	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

1101	SPI_SCLK2	SPI 2 Clock.	O
1102	SPI_SS2	SPI 2 Chip Select.	O
1103	VSSIO	Ground reference for IO pins.	S
1104	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
1105	UART_RX2	UART 2 Serial In / Receive.	I
1106	UART_TX2	UART 2 Serial Out / Transmit.	O
1107	UART_RX0	UART 0 Serial In / Receive.	I
1108	UART_TX0	UART 0 Serial Out / Transmit.	O
1109	GPIO31	General purpose IO GPIO1(15).	I/O
1110	GPIO30	General purpose IO GPIO1(14).	I/O
1111	GPIO29	General purpose IO GPIO1(13).	I/O
1112	VDD	Positive supply for logic. Connect to 1.2V supply.	S
1113	VSS	Ground reference for logic.	S
1114	VSSIO	Ground reference for IO pins.	S
1115	VDDIO	Positive supply for IO pins. Connect to 3.3V supply.	S
1116	GPIO28	General purpose IO GPIO1(12).	I/O
1117	GPIO27	General purpose IO GPIO1(11).	I/O
1118	GPIO26	General purpose IO GPIO1(10).	I/O
1119	GPIO25	General purpose IO GPIO1(9).	I/O
1120	GPIO24	General purpose IO GPIO1(8).	I/O
1121	GPIO23	General purpose IO GPIO1(7).	I/O
1122	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

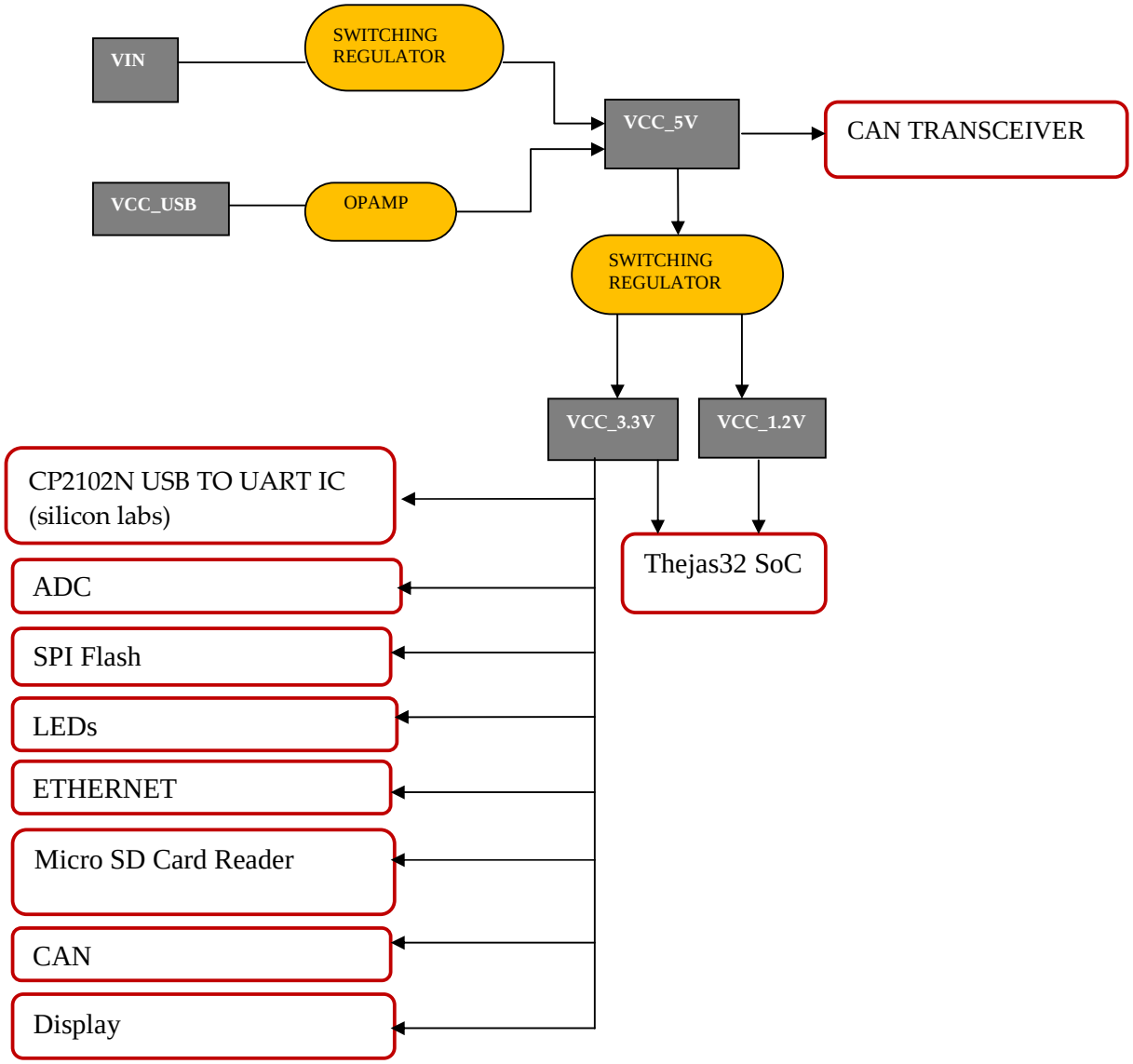
- To use Vega Arduino IDE for programming follow the steps given in the link below

  - For Linux; https://bit.ly/vega-linux
  - For Windows; https://bit.ly/vega-windows

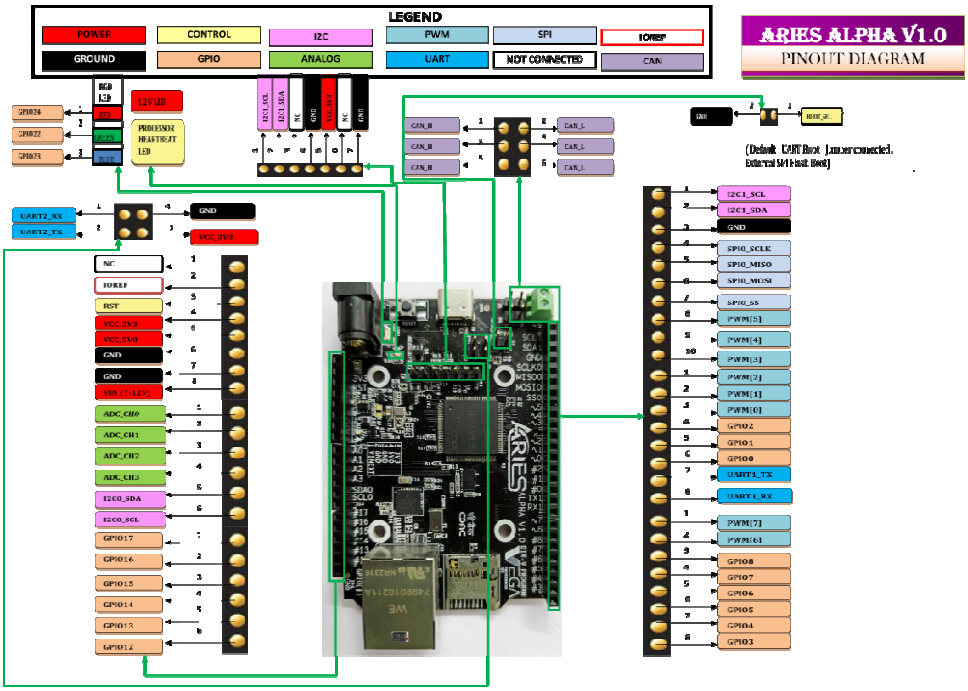
- To use Eclipse IDE for programming follow the steps given in the link below

  - https://cdac-vega.gitlab.io/sdkuserguide.html

5. Block diagram



6. Connector Pinouts



SL NO	SPECIFICATIONS	THEJAS32	ARIES BOARD	REMARKS
1	SPI (4)	SPI_SS0	J1_7	Connected to HEADER J1
2		SPI_SCLK0	J1_4	
3		SPI_MISO0	J1_5	
4		SPI_MOSI0	J1_6	
5		SPI_SS1	U6_5	Connected to ETHERNET (U6) Module
6		SPI_SCLK1	U6_4	
7		SPI_MISO1	U6_2	
8		SPI_MOSI1	U6_3	
9		SPI_SS2	U10_16,U1_2	Connected to CAN (U10) Module &SD Memory card
10		SPI_SCLK2	U10_12,U1_5	
11		SPI_MISO2	U10_15,U1_7	
12		SPI_MOSI2	U10_14,U1_3	

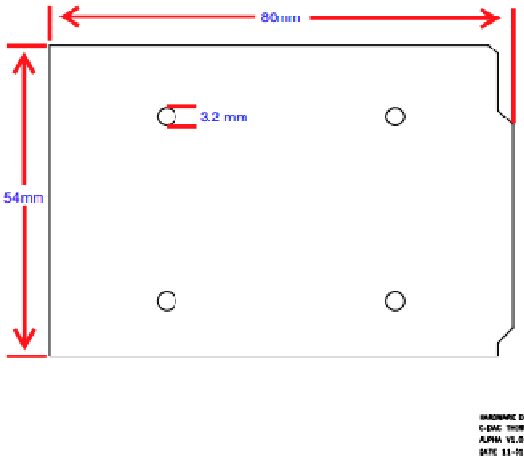
				reader(U1)
13		SPI_SS3	U12_1	Connected to SPI BOOT FLASH IC
14		SPI_SCLK3	U12_6	
15		SPI_MISO3	U12_2	
16		SPI_MOSI	U12_5	
17	I2C (3)	SCL0	J14_1	Connected to HEADER J14
18		SDA0	J14_2	
19		SCL1	J10_1,J1_1	Connected to HEADER J10 and J1
20		SDA1	J10_2,J1_2	
21		SCL2	U13_10	Connected to I2C ADC IC(U13)
22		SDA2	U13_9	
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	J8_1	Connected to HEADER J8
28		UART_TX2	J8_2	
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_10	Connected to HEADER J1
33		PWM_4	J1_9	

34		PWM_5	J1_8	
35		PWM_6	J3_2	Connected to HEADER J3
36		PWM_7	J3_1	
37	GPIO (32)	GPIO0	J2_6	Connected to HEADER J2
38		GPIO1	J2_5	
39		GPIO2	J2_4	
40		GPIO3	J3_8	Connected to HEADER J3
41		GPIO4	J3_7	
42		GPIO5	J3_6	
43		GPIO6	J3_5	
44		GPIO7	J3_4	
45		GPIO8	J3_3	
46		GPIO9	U1_9	Connected to SD Memory card reader(U1)
47		GPIO10	U10_11	Connected to CAN (U10) Module
48		GPIO11	U4_4	Connected to U4
49		GPIO12	J15_1	Connected to HEADER J15
50		GPIO13	J15_2	
51		GPIO14	J15_3	
52		GPIO15	J15_4	
53		GPIO16	J15_5	
54		GPIO17	J15_6	
55		GPIO18	U1_2	Connected to SD Memory card

				reader(U1)
56		GPIO19	U6_6	Connected to ETHERNET (U6) Module
57		GPIO20	U10_16	Connected to CAN (U10) Module
58		GPIO21	U10_17	
59		GPIO22	RGB1_3	Connected to GREEN of RGB LED
60		GPIO23	RGB1_1	Connected to BLUE of RGB LED
61		GPIO24	RGB1_4	Connected to RED of RGB LED
62	CLOCK	CLK_100M	U3_3	Connected to OSCILLATOR
63	RESET	PUSH_RESETN	U11_2	Connected to UART TO USB INTERFACE IC & RESET
64	HEART BEAT LED	PROC_HEART_BEAT	LED1_1	Connected to LED
65	BOOT SELECT	BOOT_SEL	J7_1	Connected to HEADER J7
66	ADC_CH0	_	J14_6,U13_4	ANALOG INPUTS
67	ADC_CH1	-	J14_5,U13_5	

68	ADC_CH2	-	J14_4,U13_6	Connected to HEADER J14 & I2C ADC IC
69	ADC_CH3	-	J14_3,U13_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 ALPHA V1.0 details	