Labrador
Coreboard v2.2 +
Baseboard-M v2.1

Datasheet

Contents

1 Overview **2**
1.1 Features . . . 2
1.2 Block Diagram . . . 2

2 Hardware Specifications **3**
2.1 Processor . . . 3
2.2 Memory . . . 3
2.3 Power . . . 3
2.4 Communication and Interfaces . . . 3

3 Pinout and Connections **3**
3.1 Coreboard pinout . . . 3
3.2 Baseboard pinout . . . 5
3.2.1 Debug Connector . . . 5
3.2.2 40-PIN Header . . . 5

4 Peripherals **6**
4.1 Video . . . 6
4.1.1 HDMI . . . 6
4.1.2 MIPI DSI (LCD) . . . 7
4.2 Communication . . . 8
4.2.1 Ethernet . . . 8
4.2.2 Wi-Fi . . . 8
4.2.3 Bluetooth . . . 8
4.2.4 Infrared . . . 8
4.3 USB . . . 8
4.3.1 USB 2.0 Connector . . . 8
4.3.2 USB 3.0 Micro-B Connector . . . 8
4.4 Audio . . . 8
4.4.1 Analog Audio . . . 8
4.4.2 HDMI . . . 8
4.5 Input and Output . . . 8
4.5.1 GPIO . . . 8
4.5.2 I2C, I2S, SPI . . . 9
4.5.3 UART, ADC . . . 9
4.6 Micro SD . . . 9

5 Electrical Characteristics **9**
5.1 Absolute Maximum Ratings . . . 9
5.2 Power Requirements . . . 9

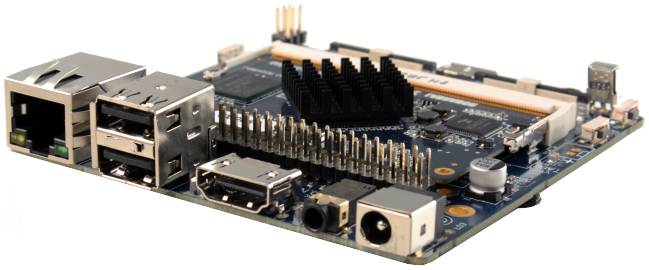
6 Mechanical Characteristics **11**

7 Support Information **11**

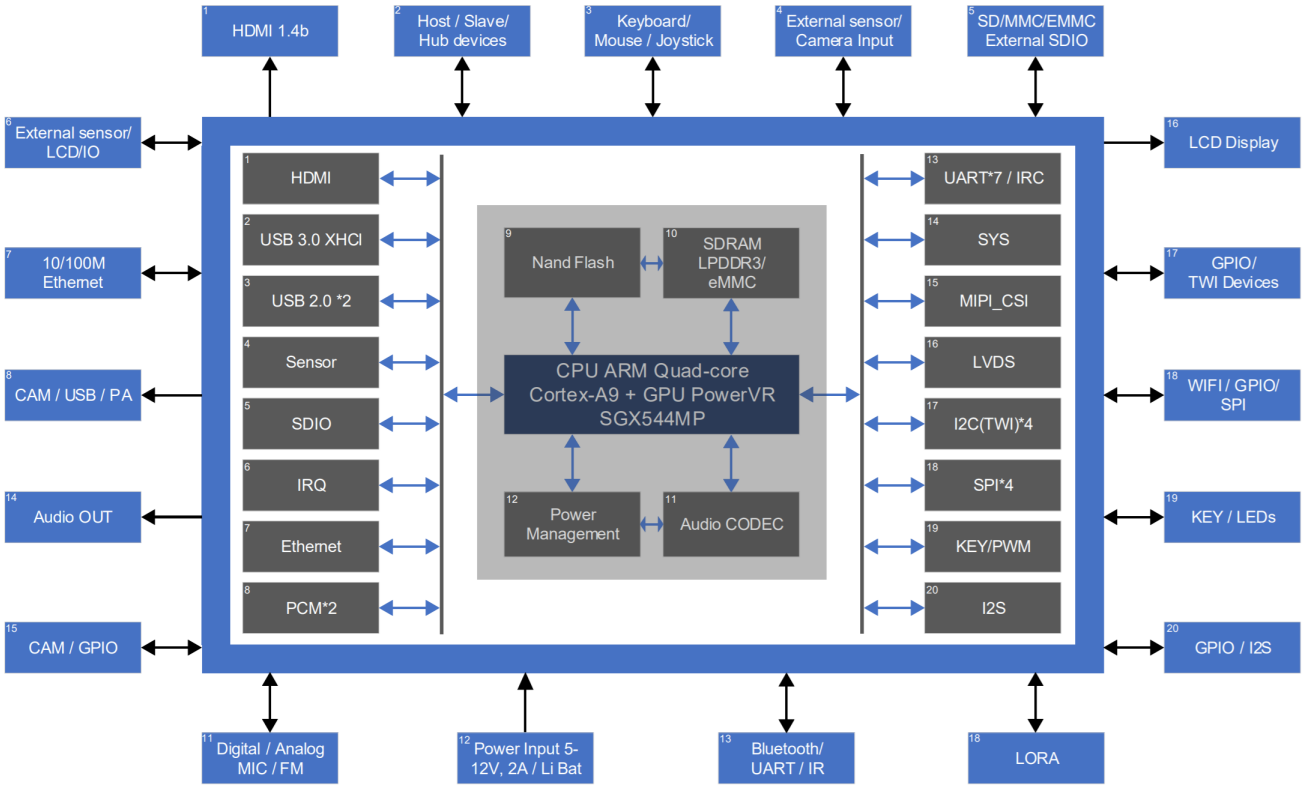
1 Overview

1.1 Features

- 32-bit Quad-core **ARM® Cortex™ A9R4** CPU;
- **Imagination SGX544** onboard GPU;
- **Two-board** design;
- **2GB LPDDR3** SDRAM;
- **16GB eMCP** flash storage;
- 2 x **type-A USB 2.0** and 1 x **micro-B USB 3.0**;
- **Wi-Fi 802.11** b/g/n 2.4GHz, **Bluetooth 4.0** and **38kHz IR** connection;
- **10/100Mbps RJ45** Ethernet;
- **HDMI 1.4b** and **LVDS** display interface;
- **Analog audio** output;
- **Linux** and **Android** support;
- Compatibility with Raspberry Pi B+ **40-pin header**.



1.2 Block Diagram



2 Hardware Specifications

2.1 Processor

The System-on-Chip (SoC) provides Labrador's processing capability. Its processor features 4-cores Cortex-A9R4 with ARMv8-A instruction set and Vector Floating Point v3, operating at up to 666 MHz; 32kB of L1 cache and 512kB of L2 cache. The graphic processing unit (GPU) for the SBC is the PowerVR SGX544MP, which has Full HD output (up to 1920x1080 @ 30fps) and supports the industry standard APIs: OpenGL ES2.0 / 1.1 and OpenVG 1.1. It features hardware-accelerated audio and video codecs capable of encoding multiple video formats up to high resolution (1080p) including MPEG-4, H.263, H.264 and H.265

2.2 Memory

Labrador Coreboard v2.1 has 2GB of SDRAM memory with standard 1333MHz LPDDR3 and an eMMC 5.1 HS400 flash with 16GB of capacity. All this in one package, increasing the integration and its autonomy for embedded storage, conserving its low power consumption.

2.3 Power

The indicated power supply for the board stands between 5 and 12V power supply with at least a 10W availability through the power jack. It also features a 2-pin PTH battery connector for powering up the Labrador with 3.7V batteries.

2.4 Communication and Interfaces

The Labrador Baseboard v1.0 features 10M / 100Mbps Ethernet connection, 2.4GHz 802.11 b / g / n Wi-Fi, Bluetooth 4.0 and a 38kHz infrared receiver. The platform features a number of readily-available interfaces for general usage. Being them Full HD HDMI and LVDS video output, Analog and I2S audio, Microphone audio input, USB 2.0 and 3.0, MicroSD card adapter, UART, ADC, DAC, I2C, I2S, SPI, CSI and DSI camera input and a 40-pin RPi compatible connector. All of those interfaces and more will be addressed in the Peripherals section.

3 Pinout and Connections

3.1 Coreboard pinout

The connection between the Labrador boards is made by a 204-pin DDR SODIMM socket that has the connectors and devices that communicate directly with the processing board. The Table 1 shows the function of each pin. The front face being left column and bottom face right column. Front face left-most pin being pin 1.

Table 1: Coreboard pinout

Function 2	Function 1	Pin		Function 1	Function 2
	GND	1	2	GND	
	I2S DOUT	3	4	ETH TX D1	
	I2S DIN	5	6	ETH TX D0	
PCM0 IN	I2S BCLK	7	8	ETH RX D1	
PCM0 OUT	I2S BCLK1	9	10	ETH RX D0	
	GND	11	12	ETH CRS DV	
PCM0 CLK	I2S LRCLK1	13	14	ETH TX EN	
PCM0 SYNC	I2S MCLK1	15	16	GND	
	UART0 TX	17	18	TX CLK	

	UART0 RX	19	20	GND	
	UART2 TX	21	22	ETH MDC	
	UART2 RX	23	24	ETH MDIO	
UART2 RTSB	GPIO D20	25	26	ETH RX ER	GPIO A17
	UART2 CTSB	27	28	TP PWD	RST
UART3 TX	GPIO D23	29	30	LCD VCC EN	
UART3 RX	GPIO D22	31	32	LED PWM	
UART3 RTSB	GPIO D24	33	34	KS OUT1	
UART3 CTSB	GPIO D25	35	36	KS OUT2	ADFU BTN
	TWI1 SCK	37	38	PCM1 IN	LCD EN
	TWI1 SDA	39	40	PCM1 OUT	ETH RST
	TWI2 SDA	41	42	PCM1 CLK	OTG EN
	TWI2 SCK	43	44	PCM1 SYNC	PA EN
	GND	45	46	SD0 D0	
SPI0 SCLK	TWI3 SCK	47	48	SD0 D1	
	GND	49	50	SD1 D1	
SPI0 SS	GPIO C23	51	52	SD0 D2	
SPI0 MOSI	TWI3 SDA	53	54	SD1 D0	
SPI0 MISO	GPIO C24	55	56	SD1 CLK	
	SENS0 D1	57	58	SVCC	
	SENS0 D0	59	60	SD1 CMD	
	SENS0 D3	61	62	SD1 D2	
	SENS0 D2	63	64	SD1 D3	
	SENS0 HSYNC	65	66	GND	
	SENS0 VSYNC	67	68	SD0 CLK	
	SENS0 D4	69	70	GND	
	SENS0 D5	71	72	SD0 D3	
	SENS0 D7	73	74	SD0 CMD	
	SENS0 D6	75	76	LCD0 D17	BLUE LED
	SD VCC	77	78	LCD0 D18	
	GND	79	80	SENS0 2V8	
	U3 DM0	81	82	SENS0 1V8	
	U3 DP0	83	84	GND	
	GND	85	86	SENS0 CKOUT	
	U3 HSON	87	88	SENS0 PCLK	
	U3 HSOP	89	90	GND	
	GND	91	92	USB DM2	
	U3 HSIN	93	94	USB DP2	
	U3 HSIP	95	96	GND	
	GND	97	98	USB DM1	
	USB3 IDPIN0	99	100	USB DP1	
SIRQ0	GPIO A24	101	102	GND	
SIRQ1	GPIO A25	103	104	HDMI CEC	
	ADC COM	105	106	HPD	
	ADC0	107	108	GND	
Earphone check	ADC2	109	110	TPCK	
TP8	PWM0	111	112	TNCK	
	IR	113	114	GND	
	ON/OFF BTN	115	116	TX OP0	
	GND	117	118	TX ON0	
	AOUTL	119	120	GND	
	AOUTR	121	122	TX OP1	
	GND	123	124	TX ON1	

VRO	125	126	GND	
VROS	127	128	TX OP2	
VMICEXT	129	130	TX ON2	
GND	131	132	GND	
MICIN	133	134	LVDS RXO0+	
MICIP	135	136	LVDS RXO0-	
GND	137	138	GND	
CVBS	139	140	LVDS RXO1+	
GND	141	142	LVDS RXO1-	
MIPI DSI DP1	143	144	GND	
MIPI DSI DN1	145	146	LVDS RXO2+	
GND	147	148	LVDS RXO2-	
MIPI DSI DP0	149	150	GND	
MIPI DSI DN0	151	152	LVDS RXOC+	GREEN LED
GND	153	154	LVDS RXOC-	
MIPI DSI DP2	155	156	GND	
MIPI DSI DN2	157	158	LVDS RXO3+	
GND	159	160	LVDS RXO3-	ETH PWR EN
MIPI DSI DP3	161	162	GND	
MIPI DSI DN3	163	164	LVDS RXE0+	
GND	165	166	LVDS RXE0-	
MIPI DSI CP	167	168	GND	
MIPI DSI CN	169	170	LVDS RXE1+	
GND	171	172	LVDS RXE1-	
LVDS RXEC-	173	174	GND	
LVDS RXEC+	175	176	LVDS RXE2+	
GND	177	178	LVDS RXE2-	
VCC	179	180	GND	
VCC	181	182	LVDS RXE3+	
VCC	183	184	LVDS RXE3-	
SYSPWR	185	186	GND	
SYSPWR	187	188	VCC3V1	
SYSPWR	189	190	VCC3V1	
SYSPWR	191	192	PMU_USB3_VBUS0	
WALL	193	194	PMU_USB3_VBUS0	
WALL	195	196	PMU_USB3_VBUS0	
WALL	197	198	LI_BAT	
WALL	199	200	LI_BAT	
LI_BAT	201	202	LI_BAT	
GND	203	204	GND	

3.2 Baseboard pinout

3.2.1 Debug Connector

The pins in the J14 set provide debug functionality by UART3 (pins 1, 3 and 5) directly connected to the processor and two channels for analog-to-digital conversion - COM0 and ADC COM (pins 2 and 4) from the PMIC. The input signal can vary from 0 to 3V. The resolution of its input is 10 bits and the sampling frequency is 3.2kHz.

3.2.2 40-PIN Header

The 40-pin header is compatible with GPIO programming through a Raspberry Pi B+ compatible header. The Table 2 shows the pins and theirs function.

Table 2: 40-pin header functions

Header	SODIMM	Function
1	N/C	3.3V
2	N/C	5V
3	41	GPIOE3 / TWI_SDATA
4	N/C	5V
5	43	GPIOE2 / TWI2_ SCLK
6	N/C	GND
7	134	GPIOB18 / OAP / TS_CLK / LCD0_D19
8	17	GPIOC27 / SPI1_SS / I2C0_SCLK / SPDIF / UART0_TX
11	161	GPIOC0 / DSI_DP3 / SD1_CLK / LCD0_D16
10	19	GPIOC26 / SPI1_MISO / I2C0_SDATA / UART0_RX
11	161	GPIOC0 / DSI_DP3 / SD1_CLK / LCD0_D16
12	34	GPIOB8 / PWM3 / SD0_CLK / KS_OUT1
13	163	GPIOC1 / DSI_DN3 / SD1_D3 / LCD0_D9
14	N/C	GND
15	167	GPIOC4 / DSI_CP / SD1_D1 / LCD0_D1
16	103	GPIOA25 / SIRQ1
17	N/C	3.3V
18	149	GPIOC6 / DSI_DP0 / UART2_RX / SPIO_MISO
19	53	GPIOC25 / TWI3_SDATA / PCM0_SYNC / SPI0_MOSI
20	N/C	GND
21	55	GPIOC24 / I2S_MCLK1 / PCM0_IN / SPI0_MISO
22	169	GPIOC5 / LCD0_D0 / DSI_CN / SD1_D0
23	47	GPIOC22 / TWI3_SCLK / PCM0_CLK / SPI0_SCLK
24	51	GPIOC23 / I2S_LRCLK1 / PCM0_OUT / SPI0_SS
25	N/C	GND
26	136	GPIOB19 / OAN / TS_START / LCD0_D15
27	140	GPIOB16 / OBP / TS_IN1 / LCD0_D21
28	146	GPIOB14 / OCP / TS_IN0 / LCD0_D23
29	148	GPIOB15 / OCN / TS_IN2 / LCD0_D22
30	N/C	GND
31	158	GPIOB10 / OEP / TS_IN7 / LCD0_DCLK0
32	154	GPIOB13 / ODN / TS_IN4 / LCD0_VSYNC0
33	9	GPIOB0 / PCM0_OUT / I2S_BCLK1
34	N/C	GND
35	13	GPIOB1 / PCM0_CLK / I2S_LRCLK1
36	7	GPIOA28 / PCM0_IN / I2S_BCLK0
37	15	GPIOB2 / PCM0_SYNC / I2S_MCLK1
38	5	GPIOA31 / I2S_D1
39	N/C	GND
40	3	GPIOA27 / I2S_D0

4 Peripherals

4.1 Video

4.1.1 HDMI

Type-A High Definition Multimedia Interface (HDMI) connector is responsible to handle a resolution up to 1920x1080 at 60Hz or 4096x2160 at 30Hz. It also supports 3D up to 1920x1080 at 60Hz. The HDMI Transmitter Core is a full-function, single-link transmitter with high-bandwidth digital content protection

(HDCP), which transmits studio-quality video and/or audio to any HDMI / DVI / HDCP-enabled digital receivers. This module is fully compliant with the HDMI 1.4b (3D Feature), DVI 1.0, and HDCP 1.1 specifications.

4.1.2 MIPI DSI (LCD)

It has 42 pin input connector MIPI-DSI used to connect RAW LCD panels up to 1920x1200. The pinout of the connector is as follows:

Table 3: Coreboard pinout

Pin	Signal
1	5V
2	TWI1_SDA
3	5V
4	TWI1_Sck
5	GND
6	TP_PWDRST(B3)
7	LCD_VCC_EN(B4)
8	LVDS_RXO1
9	GND
10	LED_PWM
11	GND
12	GPIOA24DIRQ0
13	GND
14	LVDS_REX0_P
15	LVDS_REX0_N
16	GND
17	LVDS_REX1_P
18	LVDS_REX1_N
19	GND
20	LVDS_REX2_P
21	LVDS_REX2_N
22	GND
23	LVDS_REXC_P
24	LVDS_REXC_N
25	GND
26	LVDS_REX3_P
27	LVDS_REX3_N
28	GND
29	NC
30	NC
31	NC
32	NC
33	NC
34	NC
35	NC
36	NC
37	NC
38	NC
39	NC
40	NC

41	GND
42	GND

4.2 Communication

4.2.1 Ethernet

Support 10M / 100Mbps data transfer rate through the RJ45 connector.

4.2.2 Wi-Fi

Native support to 2.4GHz 802.11 b / g / n Wi-Fi of up to 100Mbps.

4.2.3 Bluetooth

The Baseboard comes equipped with Bluetooth 4.0 with low energy specification. With a top speed of 25Mbps and a range of up to 60m.

4.2.4 Infrared

Labrador has a infrared receiver in the 38kHz frequency, being able to connect with most IR controllers and devices.

4.3 USB

4.3.1 USB 2.0 Connector

Two type-A USB 2.0 connectors, with two independent controllers inside the SoC. Supports On-The-Go (OTG) supplement.

4.3.2 USB 3.0 Micro-B Connector

The Labrador uses a Micro-B USB 3.0 connector, and supports both host and device modes.

4.4 Audio

4.4.1 Analog Audio

Analog audio output with 3.5mm PJ342 connector.

4.4.2 HDMI

The HDMI audio supports up to 8-channel Audio sample. It also supports 48k / 96k / 192k / 44.2k / 88.4k / 176.8kHz audio sample rate.

4.5 Input and Output

4.5.1 GPIO

The Labrador board GPIO is a communication point for the features brought by the SODIMM connector that supports the Coreboard. It's fully compatible with Raspberry Pi B+ family shields, including older versions (like the 26 pins headers). The Table 2 shows the pins and theirs function.

4.5.2 I2C, I2S, SPI

The I2C interface, present on pins 3 and 5 of the 40-pin connector, comes with speeds up to 400kbps, 8bit x 128 addresses for both TX and RX, and support for master and slave functions. For the SPI interface, the pins 19, 21, 23 and 24 are intended for this purpose. The I2S interface, with sampling rates of 192k / 96k / 88.2k / 48k / 44.1k / 32k / 24k / 22.05k / 16k / 12k / 11.025k / 8kHz.

4.5.3 UART, ADC

The pins in the J14 set provide debug functionality by UART3 (pins 1, 3 and 5) directly connected to the processor and two channels for analog-to-digital (ADC) conversion - COM0 and ADCCOM (pins 2 and 4) from the PMIC. The input signal can vary from 0 to 3V. The resolution of its input is 10 bits and the sampling frequency is 3.2kHz.

4.6 Micro SD

The Labrador accepts SD / HCSD / SDXC memory cards in MicroSD format, which should be allocated to the specific socket located on the Baseboard. The maximum storage capacity of the card is 2TB using MicroSDXC cards, as specified in the standard.

5 Electrical Characteristics

5.1 Absolute Maximum Ratings

These absolute maximum ratings are stress ratings, operating at or beyond these ratings for extended periods of time may result in permanent damage to the board.

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	VCC	-0.3	3.3	3.6	V
	VDD	x	1.1	x	V
	VBUS	-0.3	5	6.5	V
	USB2_5V	-0.3	5	6.5	V
	USB3_5V	-0.3	5	6.5	V
	WALL	4.28	5	12	V
	SYS_VCC	x	4.28	x	V
	SYSPWR	x	4.28	x	V
	1V8	x	1.8	x	V
	2V8	x	2.8	x	V
Input Voltage	AC_IN	-0.3	5	12	V
	Li_BAT	x	3.7	x	V
Input Current	I_IN	0	1	2	A
Ambient Temperature	Tamb	x	27	x	C

5.2 Power Requirements

Exact power requirements will be heavily dependent upon the individual use case. If an on-chip subsystem is unused, it is usually in a low power state or completely turned off. For instance, if your application does not use 3D graphics then a large part of the core digital logic will never turn on and need power. This is also the case for camera and display interfaces, HDMI, USB interfaces, video encoders and decoders, and so on. The recommendation is that designers spend time measuring and verifying power requirements for their particular use case and application. On the table there are specifications recommended minimum power supply outputs required to a nominal single board operation.

Supply	Minimum Requirement	Unit
Vbat	3.7	V
AC_IN	300	mA

6 Mechanical Characteristics

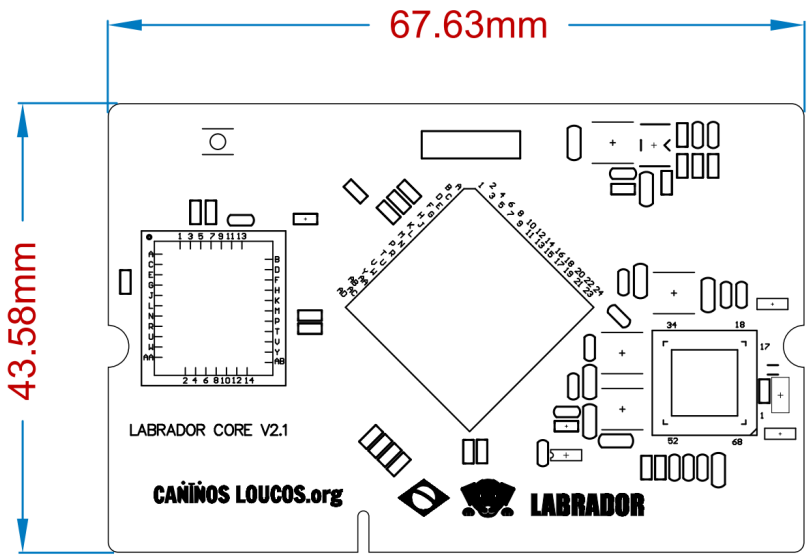


Figure 1: Labrador - Coreboard Measures

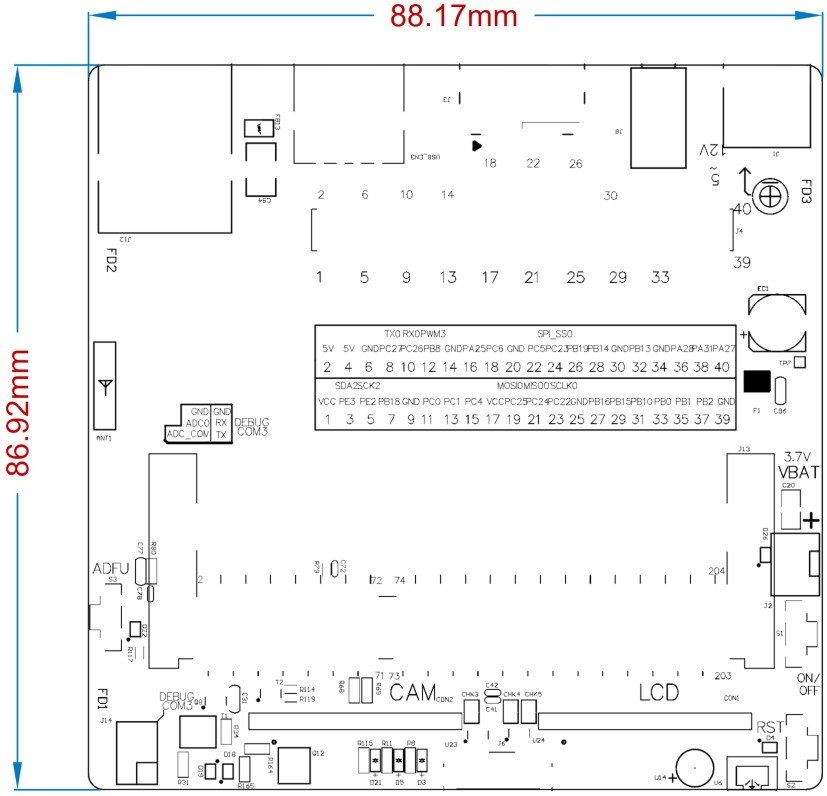


Figure 2: Labrador - Baseboard Measures

7 Support Information

Revision History

Rev. 1 - Initial creation | May 13, 2022 | AM